PROJECTIONIST

INTERNATIONAL

APRIL 1955

VOLUME 30 • NUMBER 4

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NOTE: April 1st issue of Film Daily, pages 16 to 21

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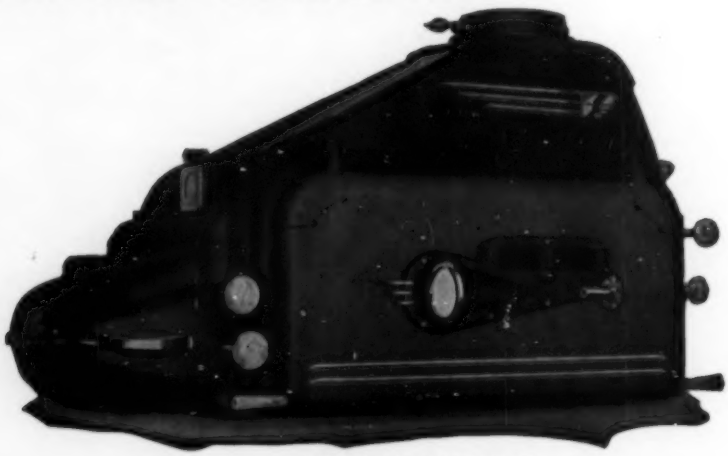

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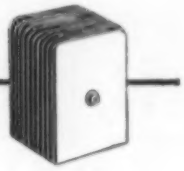

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INTERNATIONAL PROJECTIONIST

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9E

Monthly Chat

EVERY projectionist knows that one of the most acute technical problems in motion picture exhibition today is the terrific heat to which the film is subjected as it hits the projector aperture. This problem has been gradually aggravated down through the years, particularly in the larger theatres which seemed never to be satisfied with the light level they were able to obtain.

Through the years, of course, various means were devised for minimizing this problem—improved film stock, altered lamp design, and various cooling methods including filters, water-cooled gates and blower arrangements. Also, lower-speed lenses were then more common. It seems today, however, that no degree of *individual*-company effort will lick this problem. *Collective* effort might turn the trick, but this seems to be a lost cause.

Other factors besides the intensity of radiant-energy flux (when radiant-energy flux is absorbed, it is "heat"), such as the type and past history of the film, and the spectral reflection and transmission characteristics of the optical system over the entire spectrum, affect its behavior during projection and have an influence on the appearance or non-appearance of undesirable effects of heat-on-film.

Experience shows, for example, that 7-, 8-, and 9-mm Suprex carbons which are all below the threshold of in-and-out-of-focus effects, have all quite generally been free from any heat-on-film problems. The 9- and 10-mm high-intensity carbons employed in the rotating-type mirror lamp have in some cases experienced difficulty and in others been free from it.

In the condenser-type lamps, the 13.6-mm high-intensity carbons employed have been free from heat-on-film problems only in the lower part of the current range. Also quite generally recognized is that this trim at the upper part of its current range, and also the 13.6-mm Hitex super high-intensity carbon, require some protection of the film from the effects of radiant energy.

It is definitely indicated that 9- and 10-mm Hitex carbons and the 11-mm Ultrex carbon in rotating-positive, mirror-type lamps, as well as the 13.6-mm Hitex super carbon and the 13.6-mm Ultrex carbon in condenser-type lamps, will project more radiant-energy flux through the aperture than can be accommodated by black-and-white film unless preventive and corrective measures are taken.

The use of infrared-absorbing filters, infrared reflecting filters, controlled air blast and the use of a water-cooled film gate have all been asserted to provide some protection to the film. Infrared-absorbing filters can remove 40 to 50% of the total radiant energy at the film aperture with an accompanying loss of 20 to 25% of the visible light. Some infrared reflecting filters can reduce the total energy at the aperture 30 to 40% with not more than 10% loss of visible light.

It has also been concluded that suitable air-cooling of the film might permit increases of 30 to 60% in the safe maximum light intensity. Multiple usage of more than one of these protective measures may be necessary with such extremely bright sources as "Ultrex" carbons.

Announcing Still Further Improvements In the Strong Super "135"

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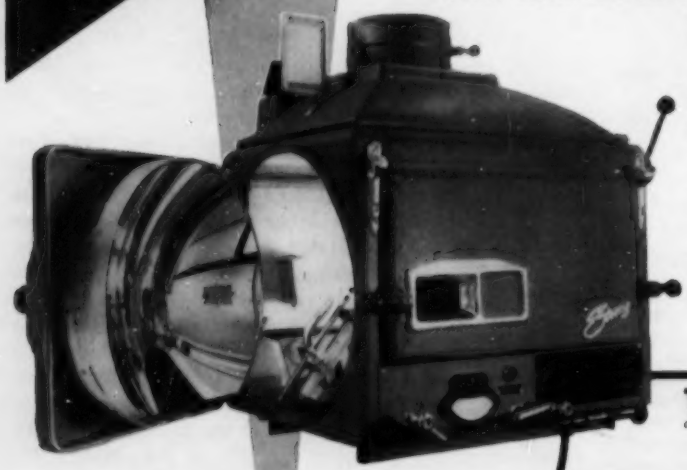
New special blower fan keeps the Strong Infra Ban Beam Cooler at a low operating temperature by removing the light energy which is neither reflected nor transmitted, but is trapped in the filter itself. The filter is mounted on a new removable holder for quick removal and ease of cleaning. This Beam Cooler and blower permit a tremendous increase in usable light without a corresponding increase in heat at the aperture.

Strong's exclusive Lightronic crater-positioning system automatically maintains the correct arc gap length and correct position of the positive arc crater at the EXACT focal point of the reflector. A perfect light, evenly distributed, of constant intensity and unchanging color value, is maintained at the screen without manual adjustments.

A stream of air directed just above the arc stabilizes its burning and prevents the deposit of soot on the reflector.



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INTERNATIONAL PROJECTIONIST

VOLUME XXX APRIL 1955 NUMBER 4

A Few Words on Diverse Topics

READERS of IP are fully conversant with Paramount Pictures' VistaVision process which involves shooting pictures on a 70-mm camera film negative and then reducing in the printing process to the conventional 35-mm positive film for projection purposes. This was originally proclaimed as standard V-V procedure enabling the showing of such releases "on standard equipment in any theatre in the world."

But when the Par people hove in Radio City Music Hall last Fall for their showing of "White Christmas" it retained its double-film image and projected it by means of the double-frame (70-mm) horizontal-pull projector[1] (Figs. 1 and 2). It is now apparent that despite the 60 feet wide by 32 feet high image at the Music Hall, Par and other producer-distributors still are enamored of mere "size" in the projected image, often without any regard for entertainment content.

57 x 27 Screen "Too Small"

Original negotiations for the current showing of "Strategic Air Command" at the Paramount Theatre in New York envisaged the showing of as large a picture as possible within the theatre's structural limitations. But evidently the distributors were horrified to learn that the maximum screen size obtainable would be 54 feet wide by 27 feet high, and this with wholly acceptable resolution and light level. This presentation would also have involved the use of double-frame film and horizontal-pull projectors.

The distributor's answer was: "Screen image not big enough." Result: the expenditure for destruction and construction in ripping out great chunks of the proscenium, as well as for the purchase and installation of new equipment, of $125,000.

The Paramount Theatre is now projecting a screen image 64 feet wide and 32 feet high, a gain of some 10 feet in width and about 5 feet in height over those dimensions originally obtainable.

In addition to the film-projector combination previously mentioned, the Paramount will use a new metalized screen fabricated by Raytone Screen Corp., new Peerless Hy-Candescent condenser-type arclamps capable of 130 amperes, the horizontal projectors made by Century, and sundry other equipment units.

The screen will be curved about 3½ inches; and a new gadget in the form of what the V-V people call a "curved aperture" will be used in the projector. Now, this aperture is not curved at all in the usual sense of the word (lying perfectly flat) but it will be curved at its top and bottom *lines* to resemble for all the world an almost exact representation of the Cinema-Scope screen image.

Understandably, such large screen

1 "The VistaVision Horizontal Projector," by James Morris; IP for October, 1954, p. 16.

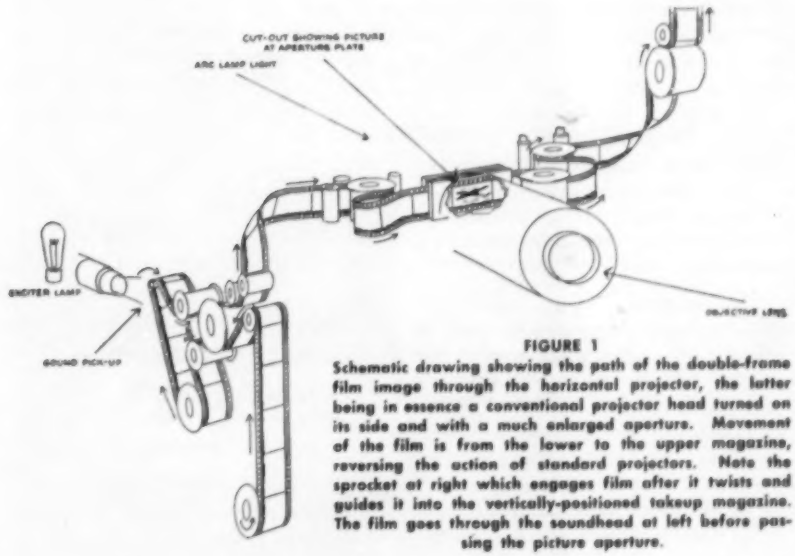

FIGURE 1

Schematic drawing showing the path of the double-frame film image through the horizontal projector, the latter being in essence a conventional projector head turned on its side and with a much enlarged aperture. Movement of the film is from the lower to the upper magazine, reversing the action of standard projectors. Note the sprocket at right which engages film after it twists and guides it into the vertically-positioned takeup magazine. The film goes through the soundhead at left before passing the picture aperture.

images are suitable for only the largest theatres.

Move Poses Some Questions

IP is extremely doubtful about the efficiency of such installations, despite a rather detailed recital of its worth by the V-V- people. For one thing, it seems apparent that those few extra feet in width and height are going to be very costly percentage-wise in terms of screen image resolution and light level. Also, by encroaching upon the height of the aperture it would seem that Paramount is also encroaching upon that factor which is always ballyhooed as vital—screen image height. Easily forgotten, it seems, is that there is not only *projection* distortion but *viewing* distortion.

IP feels, however, that Paramount is entitled to prove its assertions as to quality by actual demonstration at the Paramount Theatre—an opportunity which did not present itself before this issue went to press. No other big theatres are clamoring for these data, so a detailed exposition herein of the facts as IP sees them can safely await looking and evaluating.

TOLL TV. This question which has all exhibitor groups in a dither these days has strangely failed to ruffle the feathers, in terms of active support, of the very people who might expect to be out doing battle against it—the Tv broadcasters, the talent groups, and the advertising agencies who reap scads of money from Tv shows and talent.

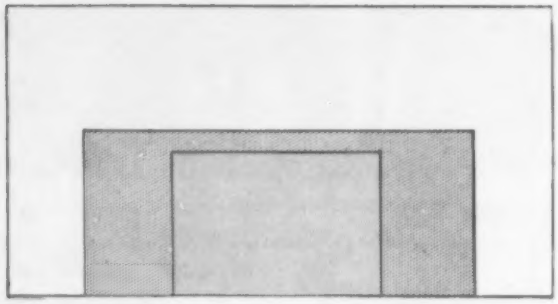

FIGURE 3

Sketch supplied by Paramount Pictures Corp., distributors NOT exhibitors, comparing the past, present and future screen sizes employed at the Paramount Theatre, N. Y. City, flagship of the theatre circuit. Implication of this sketch, as the DISTRIBUTOR sees it (backed up by positive statements in an accompanying press release) is that more SIZE resolves all problems requisite to good projection. Questions and answers stemming from this press release are contained in the accompanying article.

One sly old wag in the broadcasting industry has suggested to IP that maybe the reason for this apathy is because the aforementioned groups just don't give a damn. Consider, he added, the following hurdles for Toll-Tv to surmount:

Unfailing ample source of product; its distribution; cost of making and installing decoders on the reception end; collections, and last but not least the acquisition of suitable channels for broadcast, which feat seems at least a year removed from accomplishment. Then there is the vital factor of public resentment, because the Toll-Tv must elect one channel or other. A program is transmitted, then the screen goes blank—which means boom.

SCARE COPY. Some readers of IP were no little disturbed about our comments in last month's "Monthly Chat" in which we detailed our views about the steady, inexorable surge of producer-distributors of motion pictures now going to theatres in the direction of the Tv broadcasters.

No prophets we, nor prolific producers of "scare copy." We merely were reporting the facts as we see them while in the process of again pleading for our pet project of an all-industry conference to straighten out the kinks in thinking and procedure which have deviled our operations for the past several years.

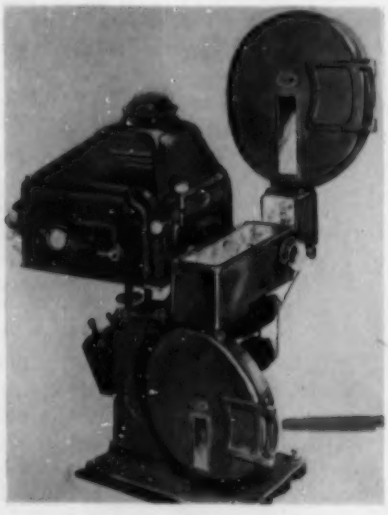

FIGURE 2

Overall representation of the double-frame-film, horizontal-operation projector as it appears when completely assembled ready for use. Note that it takes up only a little more projection-room space than a standard machine.

Elliptical Mirror Data

A VERY curious property of an ellipsoid of revolution (the solid figure created by the rotation of an ellipse about one of its axis) is its ability to bring to a focus *all* the rays emanating from a point at one of foci of the ellipse. The two geometric foci of an ellipse in reflection are optically conjugate, and a point source at one is imaged at the other by arbitrarily wide cones of light, and *without spherical abberation.*

This property of elliptical mirrors is very useful, for they can be made to collect solid angles much greater than possible with lenses, and to image the source, which must be comparatively small, without loss of light accurately where needed. This useful characteristic of elliptical mirrors applies only to the geometric foci and to small regions about the axis, so they are employed only with arc sources, where they collect more flux, but are less flexible than lens condensers.

In many incandescent filament condensing systems a spherical mirror is used to collect light which otherwise would be lost. The mirror is placed with its center of curvature in the plane of the filament, at which place the filament image will occur inverted.

The filament is thus imaged on itself with two effects: (1) the image can be shifted slightly so that the coil images fall between the coils, thus presenting a more uniform source to the rest of the system, and (2) by absorption the temperature of the filament is raised, making it brighter. This two-fold gain is possible only with sources possessing no dark region at the back as do arcs.

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11mm x 20" H. I. Projector Positive	L 0109
13.6mm x 22" H. I. Projector Positive	L 0115
13.6mm x 22" "Hitex" Super H. I. Positive	L 0175

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Light Sources for Film Projection

The fourth and concluding article in a series which detailed the various facets of arclamp construction and operation. This installment is concerned particularly with the mechanical and electrical functionings.

By ROBERT A. MITCHELL

THE mechanical and electrical functioning of an arc-lamp is of equal importance to satisfactory screen illumination. Experience has shown that projectionists' complaints center most frequently on the arc-feeding mechanism.

Carbons are fed by means of two long helically-threaded shafts which, as they revolve, move the carbon holders closer to each other at a rate regulated by the feed-control motor. The speed of the motor is directly influenced by variations in the length of the arc-gap.

Provision is also made for focusing the arc (moving it to or from the collecting element) and, in regular H.I. lamps, for continuously rotating the positive carbon.

Feed Adjustment Critical

Adjustment of any carbon-feeding mechanism is usually very critical. Dirt and improper lubrication invariably decrease its sensitivity. There are so many different types of feed-control mechanisms that the projectionist should thoroughly acquaint himself with the mechanical structure and electrical circuits employed in his own lamps. Manufacturers' instruction booklets are absolutely essential to proper maintenance.

Several of the older low-intensity (L-I) and high-intensity (H-I) reflector lamps made use of a simple relay which closed an electrical circuit to actuate the feed motor whenever lengthening of the arc-gap permitted sufficient current to pass through relay-electromagnets connected in shunt ("parallel" or "multiple") with the arc. Hundreds of these equipments are still in use.

Arc-control relays of this type work fairly well when very carefully adjusted, but they are not sufficiently responsive to small changes in current to provide the most accurate control.

Constant-Feed System

Most "simplified" H-I arcs in use at the present time employ a "constant-feed" system whereby the speed of a continuously operating motor is regulated directly by the current flowing in the arc circuit. This is accomplished by means of a special motor having, in addition to a main shunt field-coil connected across the arc, a heavy-current control winding connected in series with the arc. All of the current that flows through the arc, therefore, must also flow through the series field-coil of the motor.

The lengthening of the arc-gap as the carbons burn away causes a decrease in the current flowing through the series field-winding, speeding up the motor in the same way that a decrease of regulating-field current speeds up any D.C. motor. The carbons then feed at a faster rate, and, as the gap shortens, the current through the series winding grows stronger and slows the motor.

The length of arc-gap which it is desired to maintain is regulated by means of a rheostat connected in series with the shunt field-winding.

The Varying Feed System

The better "simplified" H-I lamps provide a means of varying the feed rate of the negative carbon relative to that of the positive. Since the burning ratio of the positive and the negative *is different for every change in arc current*, such a means is absolutely necessary to prevent a gradual "creeping" of the arc to or from the mirror.

In most lamps the ratio of carbon-feeding rates is varied by a mechanical clutch; in others (notably modern European models) two separate and independent feed motors are employed, considerably simplifying the carbon-feeding mechanism.

No matter how carefully the carbon-feed mechanism is adjusted, however, there are times when drafts, variations in current, and irregularities in the composition of the carbons result in undesirable variations in the feeding. The arc-gap may unaccountably change in length, or the entire arc creep in one direction or the other. To overcome these difficulties, modern American rotating-positive, H-I mirror arclamps incorporate electro-optical carbon-positioning devices which insure a constant, unvarying position of the positive crater at the focal point of the mirror.

Now, these lamps, even though extremely high-powered (85 to 150 amps) and utilizing rotation of the positive carbon for perfect crater formation, are actually much easier to operate than the so-called "simplified" H-I arclamps which have neither automatic focus control nor rotating carbons.

Automatic-Focus Control

The automatic focus control in the Motiograph-Hall Hi-Power H-I arclamp, to mention a favorite representative of a class containing several excellent makes, consists of a bi-metal strip upon which an image of the burning arc is focused by a special

Error in IP Equation

On page 28, column 3 of IP for March there appeared an equation which by the inadvertent inclusion of the term "x2" at the end of the first line (relating to "Height") renders the statement wholly incorrect. Here is the passage and equation correctly expressed:

"To calculate picture size for CinemaScope, the following formulas, *in which all dimensions and distances are expressed in inches*, are used:

$$\text{Height} = \frac{\text{Aperture Height} \times \text{Throw}}{\text{E.F. of lens}}$$

$$\text{Width} = \frac{\text{Aperture Width} \times \text{Throw} \times 2}{\text{E.F. of lens}}$$

These formulas may be "juggled" algebraically to find the E.F. (equivalent focal length) of lens needed to give a required CinemaScope picture height or width at a specified throw."

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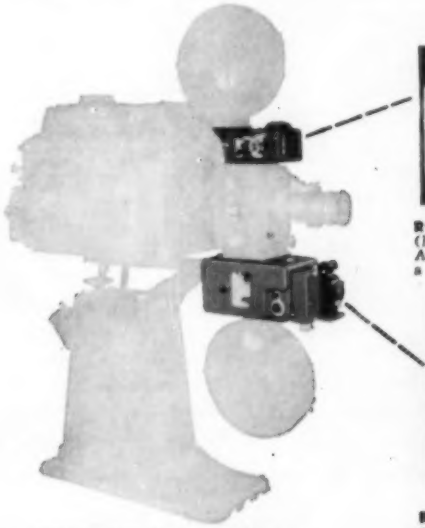
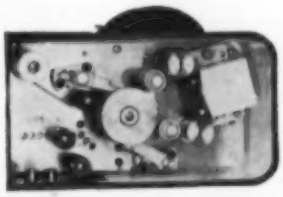
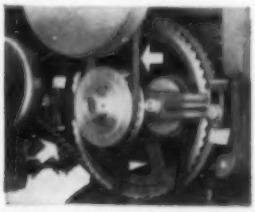


THE WESTREX R9 Stereophonic Reproducer (Magnetic) and R7 Photographic Reproducer.

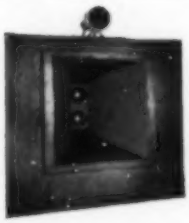


R9 STEREOPHONIC REPRODUCER (Magnetic) brings you the Academy Award winning hydro flutter suppressor, a tight film loop, and double flywheels.

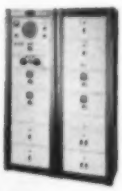


R7 PHOTOGRAPHIC REPRODUCER gives unsurpassed reproduction from variable area and density prints. Special noiseless timing belts are an exclusive feature . . . will not slip or stretch.

THIS INTEGRATOR is essential for Perspecta Sound multi-channel reproduction from a standard photographic sound track on which control frequencies have been superimposed.



THE WESTREX T501A Stage Loudspeaker Assembly features the newly designed Acoustic Lens.



THE WESTREX AMPLIFIER CABINETS can provide up to four channels for either magnetic or photographic reproduction.

THE WESTREX T502B Stage Loudspeaker Assembly was designed for larger motion picture theatres.

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FORMERLY WESTERN ELECTRIC EXPORT CORPORATION

lens-and-mirror assembly. As the positive carbon burns back away from its correct position, the image on the bi-metal strip will shift, causing the strip to bend and establish an electrical contact which operates a solenoid to increase the feed rate and return the carbon to its normal burning position.

The bi-metal strip of the automatic focus control functions as a thermostat. Since the two metals of the strip expand unequally under the influence of the heat of the crater image, the strip bends to make or break the feed-motor circuit.

Once the arc is struck, this control maintains the correct feeding, and the need for frequent hand adjustment to prevent variations in light is eliminated. Even when power fluctuations occur, the automatic focus control adjusts the arc-gap quickly and accurately.

Other types of electro-optical feed controls employ photo-electric cells actuated by light, rather than heat.

Light Color the Tipoff

All arclamps contain an adjustment for focusing the arc and for centering the arc image ("spot") on the aperture. The arc is focused by moving it forward and back while projecting blank light to the screen, with the projector shutter running to reduce heat on the projection lens. It will be found that the light will be bluish if the H-I arc is too far from the mirror; yellowish if too close. In between these two extremes is a point where the brightest pure-white illumination is obtained.

When the optimum arc position is found, the arc indicator should be adjusted so that the image of the crater edge falls upon the indicating line drawn on the indicator card or screen. It will then be possible to bring the crater to this position without looking at the screen.

The spot is centered upon the aperture by means of the horizontal and vertical mirror-adjustment knobs. Most rotating-positive, H-I lamps, however, utilize different methods of centering the spot.

The condenser-type lamp is optically the least critical: once the burners have been aligned and the condensers properly adjusted vertically, laterally, and longitudinally, no variation in the position of the spot will normally occur. The rotating-positive, mirror H-I arc, on the other hand, may require more frequent centering of the spot. This was particularly true of the old "Hi-Lo" lamp, which had the usual mirror-adjusting knobs. But in modern lamps of this type, the alignment of the positive carbon is so accurate that the mirror-moving arrangement is eliminated in favor of a smaller horizontal and vertical adjustment of the entire burner assembly.

Lamphouse Ventilation Vital

Lamphouse ventilation is a matter of the utmost importance in these days of H-I arcs. Among the several gases generated by the H-I arc are oxides of nitrogen. These are so poisonous that the vent chimneys of these arclamps *must* be connected to an adequate exhaust system to protect the health of the projectionist. An exhaust capacity of about 400 cubic feet per minute is regarded as the minimum requirement for two lamphouses. Most natural-draft flues found in theatres are wholly inadequate for the job.

It is nevertheless true that in many cases improper ventilation of the lamphouse interferes in a very serious manner with the stability of the arc stream, hence reacts unfavorably upon the brightness of the positive crater, causing the light to flicker. The arc stream is an arc of hot, electricity-conducting gas which is readily affected by drafts. In severe cases, currents of air rupture the stream completely, extinguishing the arc.

There should be little trouble with down-drafts in a well-designed ventilating system; but if the arcs are seen to flicker on windy days, the dampers should be closed off to a point just below the amount needed to prevent drafts from disturbing the quiet burning of the arc. The only feasible remedy for extreme irregularities of air-flow is the use of cone-shaped directional hoods over the chimneys of the lamphouses.

Lamphouse 'Housekeeping'

Arclamps operate dependably only when they are kept scrupulously clean. The arc dust which smuts the mirror and inner walls of the lamphouse and settles upon the gearing, impairing smooth operation, comes from the cores of the carbons. The large cores of H-I positive carbons are composed of a mix of soft carbon and rare-earth compounds which function as flame materials. Without these flame materials there would be no high-intensity effect.

Now, the rare-earth compounds in the positive cores are oxidized by the intense heat of the arc to create an ash in the form of a fine white dust. Chemical analysis reveals that this dust consists of ceric oxide and thorium dioxide together with smaller proportions of the sesquioxides of other rare-earth metals. The carbon present in the cores burns to carbon-

(Continued on page 32)

Modified C'Scope Lens For a 645-Foot 'Throw'

NEWS ITEM: Specially designed lenses 3 feet long and supported by a special tripod have been installed in the Corpus Christi Drive-In Theatre, in Texas. The lenses, to accommodate a projection "throw" of 645 feet, are said to cost $2,000.

Here are the facts anent this special lens, as supplied by Bausch & Lomb Optical Co.:

"We receive numerous inquiries from drive-ins which for CinemaScope projection require long-focal length, high-speed prime lenses. This condition exists wherever the screen size is limited or the 'throw' is long (and we have heard of some 'throws' approaching 700 feet) because of the most desirable location of the projection room or because the theatre is just plain big.

"It goes without saying that such spots need all the lens speed they can get, and in focal lengths beyond 7 inches this means larger diameter prime *and* CinemaScope lenses that can be squeezed into a 4-inch hole.

Modification Not a 'Gimmick'

"We have been able to neatly sidestep this dilemma by a factory modification of our large CinemaScope lens (at a net extra cost of $135 for each lens) which permits using a standard prime lens of exactly one-half the focal length called for in the standard table—that is, a 4 instead of an 8-inch, a 5 instead of a 10-inch, *etc.* This is not a 'gimmick' but is based on sound optical design principles and thus does not affect screen size or picture quality. By the same token, it does not give anything extra in those situations where existing high-speed Super Cinephor lenses can be used.

"Admittedly, 700-foot 'throw' drive-ins are not common; but the foregoing information will save many existing theatres considerable expense in lens equipment for CinemaScope."

THE WORLD'S MOST POWERFUL PROJECTION LAMP!

ASHCRAFT CINEX

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18 INCH REFLECTOR

MORE LIGHT

NOW LARGER SCREENS MORE BRILLIANTLY LIGHTED ARE POSSIBLE

The ultra-high speed optical system of the ASHCRAFT CINEX, with the new high speed projection lenses, will produce up to 36% more light than has heretofore been possible. We mean—with the same carbons at the same current—*More Light Through Increased Efficiency*

AIR CONDITIONED

Powerful built-in twin blowers force cold air through every part of the lamphouse, mechanism, both front and back of reflector—and eject the heat and smoke out the stack. Heat is no longer a problem.

BUILT-IN AIR-COOLED HEAT FILTER

The dichroic heat reflector which removes a substantial amount of heat from the light beam is mounted in the air stream inside the lamphouse front.

INTENSE WATER COOLING OF CARBON CONTACTS

Both contacts—of pure silver—are hollow. Cold water is forced through both contacts by the automatic water recirculator. No matter how hot the arc, the contacts are always cold.

CINEX 170 IS THE FIRST and ONLY ALL PURPOSE PROJECTION LAMP

60,000 LUMENS WITH WIDE APERTURES — *PREPARE YOUR THEATRE FOR THE FUTURE*

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Wider Screens in Drive-Ins†

The conversion of Drive-In theatres to CinemaScope is discussed herein, with emphasis on the size and surface of the screen, the light source and the possible use of multi-channel sound. Proper procedural steps are outlined.

By RALPH H. HEACOCK

Manager, Theatre Equipment Products Section of RCA

USE of the wide screen in drive-in theatres is now widespread. Although there may be some question relative to the use of multiple-channel sound, apparently most agree that the wide screen is one thing that is immediately noticed and receives favorable comment from the theatre patrons. Because of this broad acceptance of the wide screen in *indoor* theatres, the year 1954 was marked by the introduction of the wide screen in the drive-in theatre.

Drive-in theatre screens for use with the conventional 1.33 to 1 aspect ratio pictures have varied in width up to about 70 feet. During 1954 the width of drive-in theatre screens have very materially increased. The Westbury Drive-In Theatre at Westbury, Long Island, N. Y., was built during the past season, with a capacity of about 2,000 cars. The screen, seen in Fig. 1, is curved and is 124 feet wide. When a CinemaScope picture is projected, it overshoots the screen on each side by about one foot, and it completely fills the screen from top to bottom.

This gigantic picture is simply standing out in the sky, and all 2,000 of the cars in the theatre have an unobstructed view. When a conventional picture is projected, it fills the screen from top to bottom, and the width is somewhat reduced in size.

Figure 2 shows the screen at the Belmont Auto Drive-In Theatre, near Dayton, Ohio. This screen is about 110 feet wide and is flat. Here again the CinemaScope picture completely fills the screen, while the conventional picture runs the full height of the screen but not the full width.

Diffusive White Screen Surface

It is very interesting to note that both of these screen surfaces are of a white diffusive material. Many who have compared the screen image in these theatres with that obtained on a silver screen feel that both color contrast and color balance are better on a white screen. Some have commented that light distribution on the flat screen is highly satisfactory, and that there apparently is no serious fall-off in brilliancy.

Recently a screen coating material has been developed which is a real vinyl plastic material (not merely a vinyl base). This type of material was used to "mothball" the U. S. Fleet and the B-29 planes after the war. This material has been pigmented so that a mirror coat is sprayed onto the screen surface, which is then followed by a top coat which is brilliantly white and diffusive.

Cracks between panels of the existing screen are sprayed with a coat of the mirror material, and are then taped and resprayed so that the tape becomes an integral part of the screen imbedded right in the mirror coat.

The end result is that a screen surface is obtained which has practically the same reflectance as a high-grade, indoor, white diffusive screen. In addition, the material has been formulated to be highly weather-resistant. This material should be of great help in establishing high quality, high reflecting, diffusive white screens for CinemaScope use in outdoor theatres.

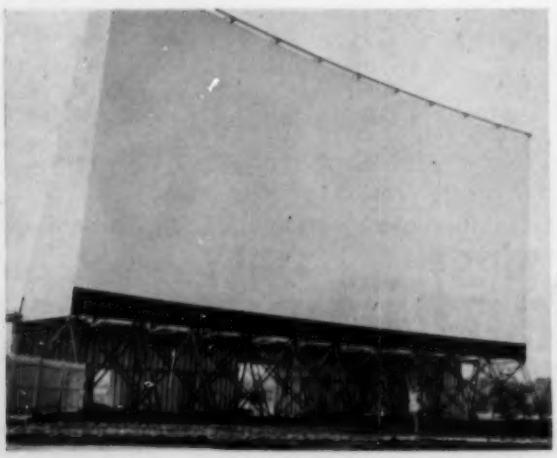
Light Requirements Stringent

The second problem in the operation of drive-in theatres of this type is a suitable light source which can provide enough light to illuminate acceptably these very large screens. In both of the outdoor theatres described, a very dependable arclamp is employed. The same arclamp may be employed for use with either the 10-mm Standard, 11-mm Standard, or the 10-mm Hitex carbon.

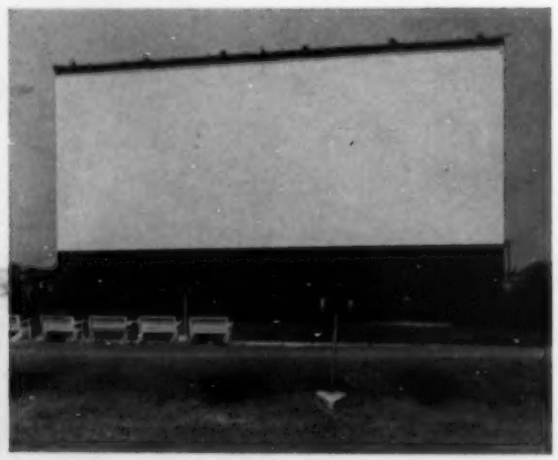
A precision-made 16-inch diameter glass reflector is employed which accurately focuses the positive carbon crater on the projector aperture. The screen end of the arclamp is equipped

(Continued on page 31)

† Journal of the SMPTE, Feb., 1955.



Two examples of modern drive-in theatre screen installations. FIG. 1 (left): the 124-foot curved screen installation at the Westbury, Long Island, N. Y. FIG. 2. The 110-foot flat screen at the Belmont Drive-In at Dayton, Ohio. One flat, one curved.



The Development of the Motion Picture Projector

The concluding article of two which trace the development of the first truly practicable motion picture projector, as recounted by a world-famous practitioner in the art.

By THOMAS ARMAT

THE RAFF and Gammon licensing arrangement started off auspiciously and financial returns were satisfactory, but troubles developed shortly. None of my patents had been issued at that date, and the applications were still pending in the patent office, two of them involved in "interferences". No patent protection could be given until patents actually issued.

Piratical machines began to appear, and in the absence of patents, could not be stopped. Later on, the Edison Co. began to be slow in supplying films. For this reason, among others, friction developed between the Edison Co. and Raff and Gammon. Still later, the Edison Co. began to market a machine that infringed my pending patents.

As soon as my patents issued, I organized a company to which I transferred my patents. Warnings were sent to infringers, and legal suits were filed. Often the suits were rendered fruitless by the simple expedient of "fading-away" by the sued infringer. The Edison Co. was making and selling many machines, called *Projectorscopes*, which infringed no less than three of my patents.

Bitter Legal Battle Begun

We demanded from users of the machines prompt payment of royalties. The Edison Co. notified users of *Projectorscopes* that they would be protected against any legal suits. That made it obligatory that we sue the Edison Co.

Meanwhile, a suit we had brought against the Biograph Co. was decided in our favor, the defendant being enjoined. On the strength of that decision, an injunction was obtained against the Edison Co. The later had pending in the U. S. Patent Office an application covering the only successful method of taking motion pictures, plus an application covering the perforated film.

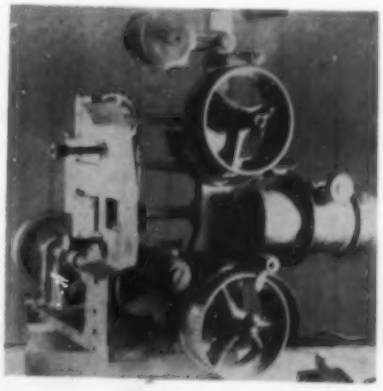
So long as the Edison Co. and we were fighting each other, no exhibition could be given without risking a suit by one side or the other. I repeatedly emphasized to Edison the obvious advantages of our getting together on some basis that would not involve the *sale* of projection machines; but without avail. After we obtained the injunction against Edison, they tried in devious ways to obtain a license from my company under which they would be permitted to sell machines. I would not agree.

From the beginning I refused to sell machines, or to license others to do so, because I felt that whatever advantage we had under our patents would be destroyed thereby; also, I felt that any profit we might make out of outright sale would not be remotely commensurate with continuing *earning power*. I wanted a royalty from exhibitors, small enough in itself, but which in the aggregate would net a handsome income.

Biograph and Edison Sued

The suit against Biograph was for an injunction and damages of $150,000. Damages were also asked of Edison. Both companies posted bonds and prepared appeals. While damages in patent suits are rarely collectible, a favorable decision in an injunction suit where damages are claimed creates a very uncomfortable feeling on the part of the defeated party and by the holders of any of their securities.

The American Mutoscope and Biograph Co. had outstanding a bond issue of $200,000. Some of the bonds were held by the Empire Trust Co., of New York, who took notice of the success of our suit for injunction and damages against the Biograph Co. After consultations with all interested parties, a stock company was formed to take over all valuable patents in the art, the stock to be distributed to the patent owners. It was a closed corporation: the stock was placed in escrow, and none of it was sold.



Courtesy, Ray Brian, Local 434

The Armat "Vitascope," first used publicly in 1896, established the basic principles of motion picture projection and inaugurated the commercial phase of the film industry.

This holding company was the Motion Picture Patents Co; and the principal beneficiaries were the Edison Co., the Biograph Co., and Armat Moving Pictures Co. I owned most of the stock in the latter. The Patents Co. was an immediate success. The royalties collected put no burden upon the industry, but resulted in a large net revenue to the Patents Co. A royalty of ½c a foot was paid by the producers, and a royalty of $2 a week was paid by the exhibitors.

'Nickleodeons' Pay Royalty

When the Patents Co. was formed, there were in the U. S. A. between 10- and 12,000 small theatres, or "nickleodeons," as they were called. The royalty of $2 weekly was a negligible sum to them; but as it was collected without cost to the Patents Co. by the simple expedient of having the distributors add this amount to their weekly film rentals, it amounted to a practically net revenue of between $20- and $24,000 weekly. The revenue of ½c a foot as film royalties also amounted to a handsome total. Unfortunately for the stockholders of the Patents Co., its life was rather a short one.

Some of the producers, for reasons I never quite understood, were refused licenses by the Patents Co. These producers, calling themselves "independents," formed an organization and put up an all-around fight. At that date anything that smacked of being a monopoly or trust was very unpopular with both the public and the courts.

Patents Company Dissolved

The "independents" charged the Patents Co. with being an unlawful monopoly under the Sherman anti-trust law, and instigated a suit by the Government against them. Judge Dickinson decided, in substance, that while a patentee had a legitimate monopoly within his patent claims, he could not, under the Sherman Act, lawfully *combine* his patent with other patents. The Patents Co. was ordered dissolved.

I have always felt that Judge Dickinson's decision was largely influenced by the fact that the Edison Co. had sold thousands of projection machines without restrictions as to their use, in some instances *guaranteeing* the right to their

(Continued on page 29)

The Improved Strong '135' Projection Arclamp

First publication anywhere of important changes in the design, construction and increase in operating efficiency effected in the Strong "135" projection arclamp now available to the trade.

By ARTHUR J. HATCH

Vice-President in Charge of Engineering
THE STRONG ELECTRIC CORPORATION

THE improvements effected in the design and construction of the latest Strong "135" arclamp are the result of steady engineering progress spurred on by the ever more severe demands by the projection field in order to cope successfully with the new techniques.

This is not to infer that every change in technique requires the abandonment of those basic principles of design, construction and operation of arclamps which over the years have proven their worth—a statement as applicable to the Strong lamp as it is to other equipments.

For example, retained in the improved Strong "135" are those salient features which have distinguished its predecessors, such as automatic positive carbon crater-positioning, single-adjustment carbon feed control, burner base focusing whereby the arc-gap is not disturbed when focusing the lamp on the aperture, and simple, sharp-line construction which enables the projectionists to keep the lamphouse clean.

Automatic Crater Positioning

Before presenting the run-down on the outstanding features of the improved Strong "135," the writer states that our review of the wide acceptance accorded the 16½-inch diameter reflector lamp which we have been manufacturing for the last five years is due in no small measure to the automatic carbon crater-positioning unit contained therein. This device will continue to be a vital feature of the improved 18-inch and 16½-inch reflector lamps which will be delivered henceforth.

Outstanding features of the improved Strong "135" are as follows:

1. 18-INCH, F:1.7 REFLECTOR. This size mirror takes full advantage of the greater acceptance angle of the new F:1.8, 1.7 and 1.5 objective lenses. This Strong reflector, when used in conjunction with one of these high-speed lenses, will produce approximately 15 to 18% more lumens on the screen *at the same arc current* used with the 16½-inch reflector.

IMPORTANT: this light gain will *not* be realized unless it is used in a projector which is *properly cleared* for the F:1.7 light beam.

Heat Dissipation Vital

2. IMPROVED HEAT FILTER. The dichroic heat filter is mounted in a holder which slides into a cast-aluminum housing which directs a stream of cooling air over the filter glass from a blower having a capacity of 100 cu. ft./min., operated from the D. C. arc supply voltage. Thus is insured a steady flow of air at all times that the lamp is operating.

This filter removes 35% of the total *energy* at the aperture, while resulting in a *visible* light loss of only 8%. This filter will be standard equipment on all 18-inch reflector lamps because we feel that its use is mandatory (at least with black-and-white film) in view of the high efficiency of the improved Strong "135" optical system and notwithstanding the fact that the projector may have a water-cooled gate and, possibly, a pulsing jet of air to stabilize the position of the film in the aperture.

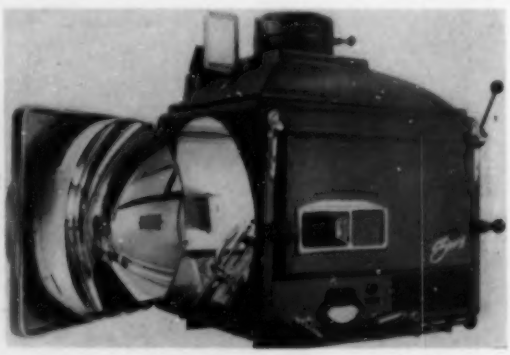
3. IMPROVED REFLECTOR COOLING AND "PURGING" OF THE FRONT SURFACE. The 18-inch reflector lamp incorporates means for cooling the rear surface of the mirror by admitting air through an opening in the rear lamphouse door, this air being drawn in by action by the lamphouse stack exhaust fan which is part of the theatre exhaust duct system. This air is so distributed and directed as to pass over the rear of the reflector, thereby reducing its temperature to a point where heat differentials as a breakage factor are negligible. Recommended exhaust stack volume of air is at least 150 cu. ft./min. from *each* lamp.

To further "purge" and keep the front surface of the reflector free from the products of combustion, two small nozzles supplied with air *under pressure* from the base of the lamp direct a stream of air *upward* and *over* the surface of the reflector. This air is supplied by blowers on the two carbon-feed motors, and this additional method of "purging" is used in conjunction with the same jet of air that is directed over the arc to chop off the tail-flame and which was used on all 16½-inch reflector lamps made to date.

Carbon Contacts; Flexibility

4. NEW-STYLE POSITIVE CONTACTS. These feature a new type of current lead to the upper contact and will insure a life-span equal to that which should be expected from solid pure silver contacts. Another feature is that the upper contact is readily removable from its tension rods for inspection and cleaning. These contacts are cooled by air supplied from the burner base reservoir.

5. FLEXIBILITY. The 18-inch reflector lamp offers extreme flexibility



The Strong Super 135 arclamp which boasts many improvements over its predecessor model, including an 18-inch, F:1.7 reflector, new long-life carbon contact, advanced cooling means and other noteworthy advances.

of interchange of burner parts so that either 9-, 10-, or 11-mm regular, or 10-mm Hitex carbons can be burned effectively. Also, the improved 16½-inch reflector lamps may be converted at any time to use the 18-inch reflector—an advantage not offered by any 16½-inch reflector lamp manufactured up to the present time.

Thus the highlights of the improved Strong "135" arclamp. A detailed description of the automatic positive carbon crater positioning system follows immediately, as a general response to numerous requests from projectionists for data thereon.

Strong's 'Lightronic' Arc-Gap Control

Here in word and illustration is a detailed description of a unit which contributes much toward the solution of a most important and long-standing projection problem.

IT IS fitting that the same group of men who developed the automatic carbon-feed control motor for projection lamps should develop a system for automatically regulating the position of the positive carbon in relation to the lamphouse optical system. The automatic feed control at least partially freed the projectionist from being shackled to the arc in the days when operating was relatively simple as compared with today.

Projectionists now must divide their attention not only to the burning arc but also to reel sequence, threading, sound, rewind, operation of the curtains by remote control, picture focus, and other details. The need for an automatic crater positioning system stemmed from the constantly-increased burning rate of the positive carbon as requirements for screen brightness have increased.

Back in the days of low-intensity arcs, the positive carbon had a burning rate of, roughly, 4 inches an hour, and the angle of convergence, or optical speed, of the light path between lamphouse and aperture was low. Today, with carbon burning rates of 18 to 30 or more inches an hour, and efficient high-speed optical systems, a variation in the burning rate of as little as 2 to 3% can in 20 minutes change the position of the positive crater in relation to lamphouse optical system as much as ¼ inch and result in undesirable color patches on the screen.

Crater Positioning Tolerance

Tests prove that the greatest amount of error that can be tolerated in the position of the positive crater in relation to the lamphouse optical system is under 1/32 inch. Exceeding this limit results in loss of illumination and change of color of the light on the screen to either blue or brown.

It is impossible to maintain the carbon position within this close tolerance without automatic means, unless the projectionist devotes his entire time to supervising this essential detail during projection. Consequently, theatres using carbons with these higher burning rates encounter color change at the screen to a degree inverse to the amount of attention the projectionist possibly can give this detail.

The Strong automatic crater positioning system controls the entire burning of the arc—both positive and negative carbons—even though the burning rate of the positive carbon at a given amperage may vary as much as *plus* or *minus* 8% of the normal value. Not only is a steady light of constant color-temperature maintained throughout the reel, but this automatic system insures that the quality of the light is *exact for both machines at all times* so that the audience will not be aware of changeovers. Any difference in light color-temperature is particularly noticeable when the incoming machine differs in a substantial respect from the outgoing machine in the quality of the light.

Unvarying Color Temperature

In the last few years projectionists and exhibitors have shown a great awareness of the importance of *correct and constant* color-temperature of the light on the screen. One of the tests for such constancy in illumination has been the new Cinerama projection technique. The light sources for the three projectors must be maintained absolutely constant in color-temperature and equally brilliant at all times during the 50-minute projection period so that the illusion of one continuous picture across the screen be preserved. To do this without an automatic crater positioning system would be utterly impossible.

In the last several years Strong-built lamps of the rotating-positive carbon type have incorporated an automatic carbon-positioning system. This system had to be the essence of simplicity, both from the standpoint of minimum maintenance cost and of being consistent with the smallest number of operating parts that can be used, so that possibility of failure be reduced drastically, if not eliminated. All contact-making devices are of the highest quality, completely enclosed and hermetically sealed so that dust and oxidation cannot affect their operation.

Since there is a particularly large amount of energy available in the carbon arc, it is not necessary to construct a super-sensitive detection device to pick up small amounts of energy and amplify them into useful quantities.

Simple Control Required

Since the source of energy being dissipated is measured in terms of kilowatts, it is only necessary to sample a small fraction of this energy to detect an error of position and directly utilize it to actuate the controls of the driving motors which feed the carbons. The control system further required that parts be easily interchangeable—particularly the electrical parts, such as contactors, relays, resistors, motors and optical elements. Simplicity of the current-adjusting control was also a requisite. It consists of a single control so that the projectionist will have the utmost degree of flexibility and ease in adjusting his lamp operation to meet any set of operating conditions.

Furthermore, a good carbon-positioning system should not be sensitive to the diameter of a carbon, the brightness of the burning arc, nor to the current intensity being fed to the arc, but rather only by the position of the gas-ball in relation to the optical system.

Because in a normal burning arc the position of the positive carbon crater in reference to the negative is determined by factors of voltage, current and arc-gap resistance, it will

(Continued on page 26)

In The SPOTLIGHT

The function of this department is to provide a forum for the exchange of news and views relative to individual and group activities by members of the organized projectionist craft and its affiliates. Contributions relative to technical and social phases of craft activity are invited.

POSSIBLE expansion of employment opportunities for members of the organized craft—projectionists, stagehands, and others — is pointed up by the aggressive promotional efforts now being expended by at least three organizations on behalf of a portable Tv projector, as follows: General Precision Laboratory, The Fleetwood Corp., and Philips, of Holland. These systems all produce a 9 x 12-foot screen image which may be picked up from either closed circuit or broadcast-Tv. Moreover, all of them feature extreme ease of operation, servicing, and portability.

IP's interest in these various units centers upon the possibility of the sponsors thereof utilizing the talents of the organized craft, which has demonstrated its ability to operate any piece of equipment designed for visual-aural reproduction.

Under prevailing conditions the expenditure of an additional $2500 for such equipment by any theatre, large or small, is extremely doubtful, considering the more immediate demand to put existing plants in order—new projectors, lenses, light sources, screens, power supply, and the like.

Additional emphasis is lent to this point by the vigorous campaign being waged by the sponsors of these equipments to place the units in convention halls, clubrooms, hotels, and sundry places of assemblage other than theatres. We may accept or reject the assertion by the portable Tv manufacturers that the extreme portability of such units will enable "bicycing" them between the theatre and the aforementioned assembly points.

Whatever may be the ultimate application of these units, these words are intended to alert the craft to be on the lookout for the installation of such equipment in their respective areas.

Such technical details relating to these units as are presently available are detailed on page 28 of this issue, together with the names and addresses of the distributors.

The IA is reportedly investing much time and effort to gaining jurisdiction over such closed-circuit Tv showings. Equipment now is handled by local Tv servicemen, hotel electricians, etc., with house porters doing the pulling-hauling chore. IA slant is that it doesn't care who *services* such units provided IA men operate, set up, and knock down the equipment—meaning projectionists and stagehands.

• More than 130 delegates to the recent California District Council No. 2 meeting visited Paramount's West Coast Studios where they witnessed a special demonstration of VistaVision. The demonstration films included identical scenes photographed with a standard *vs.* the VistaVision horizontal camera, in addition to comparison scenes projected from the regular vertical release print *vs.* the double-frame horizontal release print.

Edward Maule, chief projectionist at Paramount, welcomed the delegates on behalf of the studio. Loren Ryder, head of engineering and recording for Paramount, addressed the delegates and explained briefly the highlights of the VistaVision process.

• From the Women's Trade Union Auxiliary of IA projectionist Local 143, St. Louis, Mo., comes a request that IP publicize the extreme desirability of a women's auxiliary in all branches of the organized craft. In a supporting statement under the heading of "Ten Reasons Why You Should Join An Auxiliary to Your Husband's Union," are listed 10 persuasive reasons why such auxiliaries are extremely beneficial.

All those who view such a move with favor may obtain details by addressing Mrs. Josephine Briley, 9501 Eucalyptus Drive, Afton 23, Mo. Mrs. Briley is secretary of the Women's Trade Union Auxiliary of St. Louis Local 143.

• Irving Griebler, member of Baltimore Local 181, recently completed an assignment for the Wyeth Labs., world-famous pharmaceutical organization, in which he ran off the film

CALIFORNIA DISTRICT COUNCIL DELEGATES AT SPECIAL VISTAVISION DEMONSTRATION

"Management of Streptococcal Infection and Its Complications" before a closed-circuit Tv audience. The telecast was made over 58 Tv outlets before 20,000 physicians. The outlet was the Sheraton-Belvedere Hotel where the film was shown to the members of the Maryland Chapter of the American Academy of General Practice.

● The recent signing of a new three-year contract by Minneapolis Local 219 brought to an end the long drawn-out and often heated negotiations between the Local and the independent owners of five drive-in theatres. The new contract provides for wage status quo the first year, 5c an hour pay increase the second year, and an additional 5c per hour boost the third year.

Separate three-year contracts were signed with the Minnesota Amusement Co. and RKO Theatres, providing for no pay increase the first year, 9c per hour increase each of the following two years. Pacts signed with about 40 independent neighborhood houses also calls for no pay boost the first year, but provides for a pay increase of 8c per hour for 1956 and 1957.

William Donnelly, IA representative, assisted Local 219 officials in the negotiations.

● A gala Easter party, sponsored by the Movie Social Club of Kings County, N. Y., comprised of Local 306 members, was held on April 7 at the Home of St. Giles the Cripple, a non-sectarian hospital for underprivileged children. Such activities are standard Club procedure. Harry Garfman, Brooklyn and Queens business representative for Local 306, is in charge of arrangements for all such affairs.

● IP's office is graced by the presence of visitors from all over the world; but when writing to us upon their return to their natural habitats they never deride the splendid climate of New York City—that is, with the exception of our fellows from California. Witness the following note from our very good friend Frank McBrien, one of those Local 165 persons who exercises his undoubted talents in the projection department

Gold wrist watches were presented to President Herman Gelber (left) and Secretary Ernie Lang (right), New York Local 306, at a recent dinner given in their honor by members of the Local. Each watch is inscribed "For Faithful Service to Local 306." IA President Richard F. Walsh made the presentations.

at the M-G-M studios in Culver City, Calif.:

"I had a pleasant trip home, making very fast time from New York via plane. I must confess that I was glad to get away from your cold weather."

When Frank was here in the office and we cut up a few touches about projection techniques, did we ever mention that we do not have the California smog to contend with and that we *never* had resort to the use of smudge pots to salvage our local crops.

● Woodrow Wilson, business representative for Local 266, Jamestown, N. Y., advises that wage negotiations have been completed with Pic 17 Drive-In Theatre which resulted in a 10% wage increase plus one-hour hour warm-up period and time-and-one-half for overtime. The two-men-per-shift operation in all theatres within the Local's jurisdiction has been maintained.

Participating in the negotiations for Local 266 were Marshall Peterson, president; Ralph Turner, secretary, and Wilson.

● The New York State Association of Motion Picture Projectionists will hold its annual Spring meeting on Tuesday May 10, at Carmen's Hall, 563 Clinton Avenue, Albany. The session will open at two o'clock, following which there will be a buffet lunch at 6 p.m. The Association delegates will be the guests of Albany Local 324 at a midnight banquet, at which there will be entertainment and dancing.

● IA Cameramen's Local 644 of New York City is justifiably proud of the Academy Award to member Boris Kaufman for the best black-and-white photography in the production of "On the Waterfront." Full page ads in the trade papers proclaim that this award-winning picture was "made completely in the New York metropolitan area, with an entire camera crew from IA Local 644." Added line: "and other technical craft unions of New York.

● Department of why didn't somebody think of the idea sooner: a projectionist, writing in *Ideal Kinema* (London, England), refers to the number of "benefit" shows in which all the theatre crafts participate at no cost to the sponsors. One or two such shows a year in a given area, proceeds to go to craft welfare funds, are strictly in order, he suggests. Pointed reference is made to such shows being held for actors and musicians.

● Daniel W. Tracy, 68, president of the IBEW and member of the AF of L executive council, collapsed in the lobby of the Sheraton-Park Hotel, Washington, D. C., where he lived, and died shortly afterward.

IA ELECTIONS

LOCAL 162, SAN FRANCISCO, CALIF.

Al B. Cohn, *pres.*; Paul G. Zern, *vice-pres.*; William H. Lingle, *sec.-treas.*; Lawrence H. Weaverling, *bus. rep.*; P. G. Zern, Henry Meyer, James T. Luther, Sr., Samuel L. Johnson, Anthony J. Rondoni, *exec. board*; Neal J. Salemi, *sgt.-at-arms.*

INTERNATIONAL PROJECTION SOCIETY TORONTO CHAPTER (LOCAL 173)

H. N. "Doc" Elliott, *pres.*; Bill Hills, *vice-pres.*; John Jeffrey, *sec.*; Bob Milligan, *treas.*; Lou Lodge, A. Milligan, P. Cox, F. Cross, Jr., G. Hulse, G. Rands, H. Brooks, and M. Killem, *technical advisors.*

LOCAL 433, ROCK ISLAND, ILL.

Edward A. Short, *pres.*; Richard T. Murphy, *vice-pres.*; George A. Stoddard, *rec.-sec.*; Frederick R. Mauck, *fin.-sec.*; Lloyd Burrs, *treas.*; Fred R. Parker, *bus.-rep.*; Albert B. Adams, *sgt.-at-arms*; Roy L. Blubaugh, Kenneth L. Benedict, Paul E. Short, *trustees*; E. Short, R. Murphy, G. Stoddard, F. Mauck, and F. Parker, *exec.-board.* Messrs. Stoddard, Parker and K. L. Horton, *del., to Tri-City Federation of Labor*; K. Benedict, *del., Iowa State Federation of Labor*; G. Stoddard, *del.*, Illinois *State Federation of Labor.*

BUY SAVINGS BONDS

Tips on Filament Projection Lamps

The projectionist craft is finding ever-expanding employment opportunities at non-theatrical showings of motion pictures—industrial, educational, civic, religious and club dates. Many such showings utilize filament-lamp projectors, hence the appended notes on these lamps as supplied by Sylvania Electric Products.

PROJECTION lamps are designed to give maximum light output from the smallest, most precise source possible. It is extremely important in the design of projectors or other optical devices to obtain the ultimate in these requirements without sacrificing lamp life or presenting replacement problems.

Fundamentally, all filaments used in projection lamps are the same. Since concentration of light is so essential, tightly-wound coils of tungsten wire are used. These coils of wire are then formed into either one or two planes or further wound into coiled forms.

Monoplane, Biplane Filaments

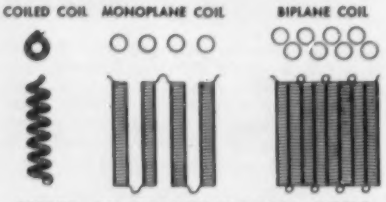
Every projection system ultimately requires as solid a mass of light as is possible. Lamps with monoplane filaments have spacing between the coils for insulation purposes. In use, one side of the flat plane of the filament faces the condenser, while the other plane faces the reflector.

The reflector is designed to refocus the filament image on the same plane as the filament itself, to fill in the spacing between the coils. This results in a near flat plane of light that is collected by the condenser and focused fairly close to the film gate to give the optical system high efficiency.

Biplane filaments consist of two planes of coils. One plane fills in the insulation spacing between the second row of coils to give an even greater concentration of light than the monoplane types of filaments. This design permits even closer focusing of the light source to the film gate, for greater efficiencies. All Sylvania biplane filament projection lamps are mechanically formed in special jigs so that each design can be accurately reproduced.

High-Quality Glass Envelopes

Most projection lamps today have striation-free glass on only *one* side of the envelope. In fact, government specifications for most projection lamps only require one side of the glass envelope to be free of striations and defects. Sylvania lamps, however, are made of carefully selected glass envelopes that are free of scratches, deformed glass and striations on *both* sides of the filament plane. This insures more uniform light distribution throughout the optical system.



TYPES OF FILAMENT LAMP COILS

Projector Design Requisites

All projectors are designed around certain types of filaments and lamp wattages. Naturally, when these are selected the optical system is designed for maximum performance. The use of increased wattage lamps will only appreciably increase the screen lumens until the filament size equals the limiting dimensions of the optical system. After that point the light losses are great and problems are encountered in dissipating the heat from the lamp, film and optical components.

High Efficiency Throughout Life

Since projection lamps are the highest efficiency filamentary types of lamps made for continuous burning, it is important that special techniques be used in their construction to guarantee satisfactory performance over their full life. Pressure filling in some of the higher wattage lamps is used to give *higher* efficiencies, longer life and to reduce bulb blackening. More important are some of the other exclusive features in Sylvania Projection Lamps that serve to maintain the filament in its proper focus position over its full life.

Here are some questions and answers relating to the structure and operation of these 16-mm projection lamps:

Are They Good for Color Projection?

Yes, Sylvania projection lamps are specially designed to produce the best possible rendition of color slides and movies. Each projection lamp filament emits "white" light containing all the colors in the spectrum so that the colors captured in slides and movies will appear on the screen with maximum fidelity.

Can I Use Larger Lamps In My Projector?

No. Lamps larger than those the projector was originally equipped with or larger than those recommended by the manufacturer may do irreparable harm to the machine and film. The cooling systems of projectors are designed for specific lamp sizes, and the heat generated by lamps too large for the system to handle may damage the optical system and injure the film.

Is It Possible To Insert The Lamp Incorrectly?

No. Good projection lamp bases are so designed that they will fit the socket only in the correct position. The lamp will slip into proper position immediately, as long as it is not jammed or forced in. Sylvania bases also seat home firmly in the socket, assuring positive contact even during excessive machine vibration.

How Long Will They Last?

Projection lamps are known as "high efficiency" lamps in the industry. This means simply that they are constructed to utilize their complete wattage so as to provide maximum brightness. Filaments of the lamps burn at white-hot

Test Your Electrical I. Q.

Here again we present a series of questions bearing on your electrical I.Q. Answer these questions, and then see how your answers compare with those on page 23.

(1) What are the regulations for wiring footlight circuits in a theatre as to size of wire, the number of lamps, junction boxes and outlets?

(2) What is the minimum size of wire that may be used for branch lighting circuits, and what is the maximum wattage permitted per branch circuit?

(3) What is an auto-transformer and where is it used?

(4) What is a volt, an ampere, an ohm and a watt? How many watts are there in one horsepower? How many kilowatts equal one horsepower?

(5) How would you change the connections to a three-phase motor in order to reverse its rotation?

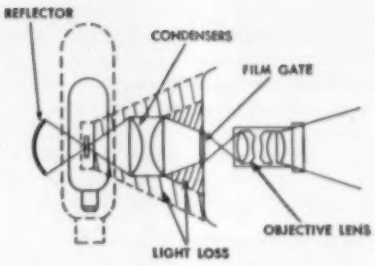
(6) What would happen if a properly fused three-phase motor blew a fuse while running?

temperatures in order to achieve full brilliance, consequently their life is considerably shorter than that of ordinary household lamps.

In spite of these "high efficiency" requirements, Sylvania projection lamps last longer—from 10 hours for 1000-watt lamps up to 100 hours for the 110-watt lamps.

Why Do Some Lamps Have Black Tops?

Tremendous amounts of light are developed by the higher wattage lamps to achieve full brilliance for large size screens. The black caps on these lamps absorb excess light that would otherwise radiate throughout darkened rooms from the machine's ventilating system, interferring with viewer's vision.



LIGHT LOSS WITH OVERSIZED LAMP

by the lamp equipment, no definite rules anent blade width can be given.

It is best to have the blades a trifle wider than is absolutely necessary in order to "kill" travel-ghost, rather than *a bit* too narrow. The amount of light gained or lost in this case is insignificant. A 3% increase of light is much too small to be seen by anyone; yet many propectionists trim their blades by 5 degrees to get this slight amount of extra light and run the risk of spoiling the clarity and steadiness of their pictures.

'Reasonable' Trimming

Even when the blades aren't trimmed down enough to cause a definite "ghost," an annoying trembling of bright objects in the picture may be introduced. This is why we advocate shutter blades that are wide enough to conceal *all* motion of the film.

If one blade of the shutter be a little wider or narrower than the other, a terrible flicker will be produced. Otherwise, the width of the blades, within reason, has no perceptible effect on flicker.

Shutter Blade Width & Image Flicker

The question of flicker in the projected screen image and its direct relationship to shutter blade width and illumination level has been discussed frequently in these columns—yet it constantly keeps cropping up. Here it is again.

By ALLAN P. MULCAHY
Rossland, B. C., Canada

A brother projectionist who has been in the craft ever so many years longer than I abides by a cardinal rule that as one increases the illumination one should increase the width of the master (and flicker) shutter blade in order to eliminate flicker.

Originally he had a set-up of Simplex Regular heads with 90-degree rear shutters and Peerless low-intensity (L-I) lamps. He asserts that when he replaced his lamps with Peerless Magnarcs he had to make the blades about 109 degrees in order to eliminate flicker.

His theory would be that since the amount of light is greater with H-I light than with L-I, then the period of darkness during the pull-down should be longer to suppress flicker.

Shutter Cut-off Period

It seems to me that the period of darkness should be as short as possible irrespective of any illumination level so that "persistence of vision" would more readily lend itself to the impression of illumination during the time the shutter is closed. I can see, however, that with larger lamps and larger mirrors the shutter has to cut a greater "disc" of light, thus making necessary increased shutter blades, or else moving the shutter as close to the aperture as possible, as on the Simplex X-L head.

EDITOR'S REPLY: Even though the increase in light transmission is too small to be perceptible, many projectionists trim their shutter blades down beyond the theoretical limit. A shutter excessively trimmed reveals travel-ghost on the screen. Travel-ghost, however, is much fainter than the brightest areas in the picture, hence it is not seen by the average theatre patron if screen illumination be kept below a certain limital value.

When a change is made in lamp equipment to increase illumination, the travel-ghost which previously was practically invisible suddenly shows up. As a result, the shutter blades have to be widened. This is exactly what has been done in this case. Several projector manufacturers furnish two types of shutter: one with blades of normal width for high-level screen brightness, and another having excessively trimmed blades for drive-ins and other theatres where adequate screen illumination is difficult to obtain. Still other manufacturers make their shutters with adjustable-width blades.

Screen Brightness Factor

If intermittent pull-down and cut-off of the light by the shutter were *truly* instantaneous, shutters for use with standard 3/1 Geneva intermittents should have 90-degree blades to mask all travel-ghost. Although the action of shutter and intermittent sprocket is *not* instantaneous, no harm is done by 90-degree shutter blades if screen light be not too bright.

The width of the blades is determined by such factors as size and rotational speed of the shutter, its distance from the aperture, and the diameter of the light beam where cut off by the shutter. Since the last-named factor is governed

BOOK REVIEW

KINOTEKNIK, *by Max Scharnberg. Third revised edition, 580 pages. Published by Jul. Forlag, Copenhagen, Denmark.*

This edition is an important contribution to the technical literature; it is regrettable that it is written in Danish and thus is available to only a limited number of projectionists. The history of projection is accorded a remarkably complete treatment in *Kinoteknik*, as are also the optical, electrical, and acoustical principles involved in the projectionist's art.

The bulk of this comprehensive textbook, however, is devoted to practical instruction in 35- and 16-mm sound projection. Equipment commonly used in Denmark is described in detail.

Famous Projector Names Missing

Among the theatre projectors illustrated we find the Kalee, Aga-Baltic, Askania, Bauer, Bofa, Gaumont-Kalee, Philips, Westar (Century-Westrex), and Zeiss-Ikon (Ernemann). But we looked in vain for our old reliable friends, the Simplex, Motiograph, and Brenkert of world-wide fame and favor! On the other hand, American textbooks of projection make no mention of well-known European machines. Among the many technical credits in the book, we note with a glow of pride, the inclusion of IP in many instances.

Herr Scharnberg's treatment of projection (including color movies, theatre-Tv, 3-D, wide-screen, and CinemaScope) is comprehensive, concise, systematic, and down-to-earth. Only the language-barrier is to be regretted in this valuable source book.

The Ole Crank-Twister

Subject; Linearity

Embedded in this literary fol-de-rol is a very practical projection suggestion. This is tom-foolery in earnest.

PROJECTIONISTS is just like people. After they bin doin a fixed routeen for a long time they just gets linear—a fancy way of sayin that they forget to change when the routeen gets changed.

Take Pete Hackleback, fer instince. Pete is my pardner and works the No. 2 machine—under my close supervision, of course. This old crank-twister is CHIEF! at the Carousel Theatre where projectin pictures takes its proper place. We figger that our job is up on a pinnical and just as important as all the actin and producin and ballywhoin that goes into a movie. Anyhow, the projectin booth at the Carousel is bolted to the rafters of the roof—and nobody can get at us after we pull the rope ladder.

Only 50 Years at Craft

No doubt about it, Pete is a good man on the job but he aint been in the game so long. The ole crank-twister distinkly remembers breakin him in about the time of "The Great Train Robbery," so with his limited expereence he has a lot to learn about projectin.

Little while back he was runnin a premeer showin in Cinemascoper with the big markee sign announcin "The Ole Crank-Twister now operatin." Natchur-the big markee sign announcin "The Ole pressin mob the scalpers hawkin standin room tickets was as busy as the dips who was dippin hip pockets.

Seein is Believin

Everything runnin as per usual up in the booth except that the Ole Twister with his unerrin mind decides to check up on his pardner. Youd never guess what. Here Pete has Part 7 all set to go but has skipped the X-L magnetic head. This gets us back to the subject of forgettin—which is what we wanted

(Continued on next page)

The New Victor "1600" Portable Arclamp Projector

AN extremely portable 16-mm projector and arclamp combination designed to provide professional results for showing of industrial, religious and similar types of non-theatrical films, is available from Victor Animatograph Corp., Davenport, Iowa.

Three-unit portability is an important feature of the Victor "1600" arc projector. First, the rectifier serves as a base for the complete unit. The second unit is a lamphouse. The bass-reflex speaker in the third unit serves as a carrying case for projector head, amplifier, reel arms, power cords, extra carbons and takeup reel. The parts contained in the three units can be set up for operation within 5 minutes. Total weight of all three units is 207 pounds.

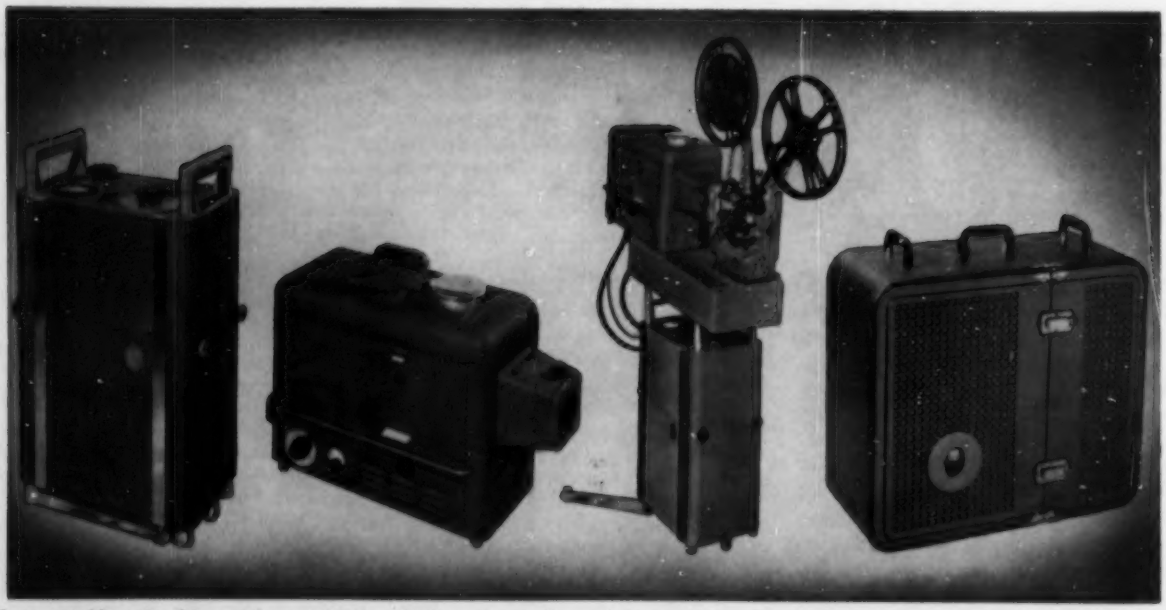
The combination rectifier and base has stabilizing swing-out legs with built-in floor levelers for quick and easy setup on uneven floors. Blower cooling is used to insure longer rectifier life. A positive lock-tilt assures fast, accurate picture centering on the screen from any angle or throw, vertically or horizontally.

Delivers 1600 Lumens to Screen

The source of illumination for the Victor 1600 is a self-contained portable arclamp which, though small in size, delivers 1600 lumens to the screen over a full hour show period and uses only one carbon trim pulling 30 amps. This arclamp is easily attached to the amplifier unit by means of a finger-tip, snap-lock catch. The lamp has a built-in ammeter enabling a quick check on operation.

The amplifier itself has convenient top-mounted controls. Arranged on the control panel are an amplifier "on-off" switch, a 3-amp fuse, separate exciter lamp switch, individual tone and volume controls, phone input and volume control.

More complete data on this unit is available from Victor Animatograph Co., Davenport, Iowa.



Three portable units that can be quickly assembled to set up the Victor "1600" Arclamp projector, along with a view of the assembled projector ready for action. At the left is the combination rectifier and base. Next to it is the portable arclamp. The bass reflex speaker shown at the right also serves as a carrying case for the projector head, amplifier and other parts. The assembled projector is shown second from the right. Note the position of the amplifier unit which is removed from the speaker case and positioned between the rectifier base and the arclamp and projector mechanism. These units have undergone severe field tests prior to being offered on the market.

to holler about in the first place.

Well, instead of preachin to Pete—which dont never do no good—the Ole Twister decides then and there to do sumthin different.

You know them equalizin drums in the X-L magnetic head is black as a widow spider in a coal bin. You cant see em turn. So Ole Twister gets the bright idee to paint half of the edge of each drum white. Now after you cut a projector the white spots keep awhirlin around in front of your nose for a good 4 minutes. With that goin on how can you ferget?

If Pete ever again fergets an skips the magnetic head he aint dumb but just stupid, and the Ole Twister is gonna apply a crank handle right across the place his brains shouldnt be. Pete is some charicter. When I was writin this little sermin he was lookin over my shoulder. Told me I was spellin the word "linear" wrong. Just to please him I spelled it his way.

FRANK W. MACDONALD
IA Local 199, Detroit, Michigan

Electrical Exam Answers

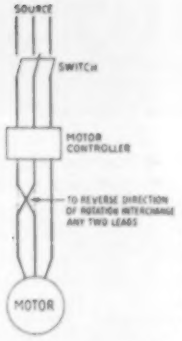
Here are answers to the electrical licensing examination questions posed on page 20.

(1) Footlights must be wired with at least No. 14 B & S gauge double-braided, rubber-covered wire. No more than 1320 watts or 32 receptacles to be dependent upon a final cut-out. Receptacles must be enclosed within approved boxes as must junction boxes of an approved type, properly enclosed and readily accessible for inspection.

(2) The minimum size of wire for branch lighting circuits is No. 14, the maximum wattage permitted per branch being 1650.

(3) An auto-transformer is a type of transformer in which one winding serves for *both* primary and secondary. Auto-transformers are used where the ratio of transformation is small, as in A.C. motor starters and in certain other applications, as a considerable saving in copper and iron can be effected, and the whole transformer reduced in size as compared with one having separate windings. For the secondary circuit, one wire is connected to one end of the coil, and the other to some intermediate point, depending upon the desired ratio of transformation.

(4) A volt is the electromotive force which produces a current of one ampere when steadily applied to a conductor having a resistance of 1 ohm. An ampere is the current which when passed through a solution of nitrate of silver in water, in accordance with certain specifications, deposits silver at the rate of 1.118 milligrams per second. An ohm is the resistance of a column of mercury (at the temperature of melting ice) of uniform cross-section of one square millimeter and a length of 106.3 centimeters. A watt is the power expended by a current of one ampere in a resistance of one ohm. One horsepower equals 746 watts. Since one kilowatt equals 1000 watts, it follows that one kilowatt eqquals 1,000/746 or approximately 1.35 horsepower.



Drawing illustrates how a reversal of rotation may be obtained in an alternating-current motor.

(5) By interchanging any two of its power supply leads, as shown in the accompanying diagram.

(6) It would cause the motor to either run very slowly or stop altogether, depending upon the electrical load. If the motor be equipped with proper overload protection, the functioning of these would automatically disconnect the motor from the line. If, on the other hand, no protective devices be available, the motor would heat up, perhaps sufficiently to cause damage to its windings.

***Questions and answers are presented through the courtesy of Theo. Audel & Co., publisher of Audel's Questions and Answers for Electricians Examinations.**

Motiograph Adds Products

Motiograph, Inc., has developed a new low-cost in-car speaker, its aluminum housing containing a 4-inch diameter speaker unit. This speaker and junction box is known as the Economy Line, which with the Rainmaster Series and the DeLuxe plastic line enables Motiograph to give drive-in theatre owners a wide choice of in-car speaker equipment.

To meet the increased demand for greater screen illumination Motiograph is making its Hi-Power arclamp for 115-ampere operation. Motiograph also has a new line of selenium rectifiers for lamps operating up to 135 amperes; and has added a new 160/320-ampere generator to its line.

New 20th-Fox Process Delayed

Although 20th Century-Fox has plans for a new projection process for road-shows, utilizing oversize prints from oversize negatives, actual use of the process is probably about two years away, it is reported.

Fox has been experimenting with a 65-mm camera and projection process with a straight projection pulldown similar to that used by Todd-AO, but it is reported that Fox found the 65-mm film unsatisfactory for projection because of its tendency to buckle and thus go out of focus. Now experiments are continuing with 55-mm rather than 65-mm prints. Use of this process would not interfere with distribution of 35-mm CinemaScope prints.

All-Purpose Film Process is Foreseen by Technicolor

Working out of an all-purpose motion picture production process, which would start with a large-area camera negative capable of providing prints suitable for a variety of presentation methods should be the technical goal of the film industry at this time, says Herbert T. Kalmus, president of the Technicolor companies.

"We visualize a process," he said, "which starts with an increased negative area of theoretically best area and dimensions which may be printed and re-photographed to yield prints suitable for: (a) large screen special theatre projection; (b) any theatre projecting 35-mm prints with a screen of any size and shape; (c) 16-mm projection, and (d) television." Prints would be made to carry any existing sound system, stereophonic or otherwise.

RKO Theatres 1954 Profits

RKO Theatres' net income in 1954 was $829,920, compared with a loss of $296,570 in 1953. In a report on operations, RKO revealed that in excess of $600,000 was expended during 1954 on new screens, sound equipment, lenses, projectors and other theatre improvements. This compares with an expenditure of $1,500,000 for new equipment in 1953. All RKO theatres now have every facility for projecting films in all new media in general use.

Ryder Hits Equipment Cost

Warning against new projection processes that are too costly for theatre installation was issued by Loren Ryder, chief of Paramount's research and sound department, at a recent meeting of the West Coast section of the SMPTE, held on the Paramount lot.

The only solution to the problem of incompatible aspect ratios and processes is for industry technicians to get together in "honest criticism" of each others' thinking, he said. "Let us compare our work in the laboratories and not at the expense of the theatres and the studios."

Magnetic vs. Optical Sound

To the Editor of IP:

I am convinced that magnetic sound quality is far superior to optical. Contrast the orchestral passages in the film "Garden of Evil" (CinemaScope), wherein the sound fairly lifted one out of one's seat, with those in "Rhapsody" (MGM Perspecta). This latter film had all the opportunities for Hi-Fi musical reproduction, and while it was undoubtedly good, it was miles behind the magnetic four-track job.

Unfortunately, all the local CinemaScope installations are using single-track optical sound, the full stereo-sound installation proving too costly. A pair of anamorphic lenses and a new screen is about $1250. for a small suburban show, which can utilize its existing arclamps.

DAVID BLISS

Townsville, Queensland, Australia

BY THE EDITOR: Much of the enthusiasm for CinemaScope stereophonic magnetic-track *orchestral* recordings is undoubtedly due to the fact that these recordings are *truly* stereophonic. Not so with Perspecta directional tracks, which are physically incapable of splitting up simultaneous sources so as to reproduce the natural effect of an orchestra.

In Perspecta reproduction, the flutes cannot be separated from the violins, if both are playing at the same time at different parts of the screen. The most that Perspecta can do is switch *all* of the sound—all instruments—to one or more of the three sets of speakers.

As regards *fidelity* of reproduction—and here we shall have to compare single-track, non-directional optical sound—the differences are real but misleading.

The writer recalls a theatre in which the non-sync scratch filters were accidentally shunted across the photocells of the soundheads, cutting off the higher frequencies. The audience was delighted by the deep, resonant response, and wondered if new equipment were responsible for the vastly "improved" sound! The sound engineer "blew his top"—not because of the projectionist's oversight but because of the public's stupidity and utter lack of appreciation of full-range reproduction. Hi-fi is not, and never was, the public's cup of tea.

CinemaScope magnetic recording certainly suppresses the higher frequencies of audible sound high-frequency attenuation, however, is pleasing to the average listener. No surface noise—no shrill harmonics—relatively louder bass. Just soothing sound that gently caresses the eardrums.

'Natural' vs. 'Unnatural' Sound

All that, however, is *unnatural* sound. It makes music sound better, but muffles voice harmonics just enough to interfere with intelligibility. It is the kind of sound which is *deliberately* built into commercial radios and phonographs. It is as unnatural as the tinted-base movie film which the public still prefers to clear-base film for black-and-white prints.

Frequency-response tests in optical-sound systems have been a standard tool in the service engineers little black bag for many years. To date, the proponents of CinemaScope magnetic sound have kept suspiciously aloof from down-to-earth field evaluations of the response characteristics of CinemaScope magnetic sound.

And for good reason, apparently. A 10,000-cycle magnetic-track test film simply won't impart the slightest wiggle to the needle of a volume meter in the average theatre outfitted for magnetic reproduction.

We Try to Please

To the Editor of IP:

Just a few words of complaint (and indirectly a boost) about the way some articles are handled in IP. For some time I have kept a file of IP articles that I feel may be of use to me at a later date. But some articles are printed with photos back-to-back or else overlapping in such a manner that it is not possible to cut them out and paste them in a scrapbook without destroying one or the other. Moreover, to save *all* the pages, advertisements included, fills a binder in short order.

Is it possible to eliminate this condition for the aforementioned reasons?

JAMES A. HINDMAN

Rochester, Penna.

[EDITOR'S REPLY: Mr. Hindman's view has been expressed on various occasions by other readers of IP. Unfortunately, the exigencies of publication, particularly in a journal presenting technical data, militate against adoption of his suggestion, especially if a reasonable degree of continuity is to be realized. It would seem that the simplest procedure would be to use not a pasted-up scrapbook but a looseleaf binder, using the side margin for the punch holes.]

IP Truly International

To the Editor of IP:

Mr. Jean Suquet of Societe Le Carbone-Lorraine, in charge of the Lorraine Orlux carbon manufacturing plant and responsible for the manufacture, production and design of all Lorraine Orlux carbons, has been visiting with me, and we in turn have been visiting with projectionists in the East, Midwest and Southwest areas. His discussions with projectionists have been most instructive.

Mr. Suquet is a Paris, France, subscriber and an ardent reader of your publication. He advised me that the down-to-earth technical articles published in INTERNATIONAL PROJECTIONIST are most easy to read and understand, and are on the "must read" list for his engineers. He also stated that IP is widely read by projection technicians on the Continent.

EDWARD LACHMAN

Carbons, Inc., Boontoon, N. J.

LENS-CLEANING RULES

1. Remove dust. (Blow, brush or wipe off.)
2. Clean with water, detergent solution, or mild soap. Rinse scum-free.
3. Always use dust-free cloths, cotton, or lens tissue.
4. Never use cleaning powders.
5. Silicone-treated cloths, now being widely touted as "cleaning" aids, should *never* be used on coated lenses.

Post These Rules for Ready Reference

Todd AO Opening Delay

Opening of the film, "Oklahoma" in the Todd-AO process at the Rivoli Theatre in New York City will probably be delayed until as late as July. The delay is due in part to uncertainty over the lease for the theatre which must be renewed within a year. Backers of the Todd AO process are reluctant to make the large investment for installing Todd AO projection equipment until the lease question is settled.

Picture Attendance Is Rising But 'Lost' Audience Remains

Despite gains in box office revenue and attendance during 1954, the exhibition industry should not allow itself to be lulled into the feeling that all is well, informed industry circles feel. The job of recovering the "lost" audience is much more formidable, as is clearly demonstrated by recent figures from the Census Bureau, U. S. Commerce Dept.

The government estimates the population gain from July, 1946, to October 1, 1954, at 15.4%, or from 141,389,000 to 163,211,000. The estimated weekly attendance at motion picture theatres in 1946, the record year for the industry, was 90,000,000, while the attendance figure for 1953 was 50,000,000, and for 1954, 52,000,000.

Examined from this perspective, the 4% gain in attendance between 1953 and 1954 seems quite small. If figures on attendance are considered in relation to population increase, theatres would have to sell tickets to close to 100,000,000 people each week to equal the record set in 1946. This would be almost twice the weekly average for 1954.

AO's New Film Division

American Optical Co., co-partners in the Todd AO wide-film motion picture system, has created a new division to handle the exploitation and commercial application of all its motion picture products. William F. Peck, formerly of the Instrument Division at Buffalo, N. Y., will be general manager.

Kodak 16-mm Pageant Pamphlet

A pamphlet describing the new Kodascope Pageant series of 16-mm sound and silent projectors and their uses under varying conditions of audio-visual operation is now available. The Pageant series includes a wide range of models which make possible the selection by business and other users of equipment exactly tailored to virtually any projection requirement. An exclusive feature is "permanent pre-lubrication," which eliminates over- or under-oiling, the chief cause of projection wear. The pamphlet is available free from Eastman Kodak, Dept. 2, Rochester 4, N. Y.

Huge Film Storage Center

Consolidated Film Industries, of Fort Lee, N. J., has completed a new film storage building capable of accommodating 60,000,000 feet of film under electrically-controlled temperature and humidity conditions. Said to be the only storage center in the U. S. designed for long-term scientific film protection, a constant 72-degree temperature and a 50% relative humidity is maintained.

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'LIGHTRONIC' ARC CONTROL

(Continued from page 17)

readily be seen that to successfully control the position of the positive crater and maintain a stable burning arc it is also necessary to control the position of the negative carbon electrodes in coordination and in conjunction with the positive. For this reason, the ideal system should control not only the positive but the negative carbon as well, and the position of the negative carbon should be such that the arc will burn in a stable manner when the positive is held in its prescribed position in regard to the optical system. The Strong carbon-positioning system embraces all these requirements.

Design of Arc Control

The components that make up the carbon regulating and feeding systems are simple, and include a hermetically-sealed, double-compensated bimetallic element which is sensitive to the radiant energy taken from a portion of the carbon arc in the arc stream and adjacent to the crater face. The optical system which concentrates this energy on the bimetal tube is a single element, in that the condenser is ground on one face of the prism.

The bimetallic switch is arranged so that it directly controls the motor field of the positive and negative motors, which are connected to feed their respective carbons. This control relay shunts out the resistance in one field of one feed motor while at the same time it is releasing this shunt resistor from the control field of the other feed motor; thus, one motor is slowed down and the other speeded up to maintain a constant arc-gap length and still meet the requirements for adjusting the positive carbon either in one direction or the other to maintain it at the correct focal point.

A simple analogy of the manner in which the bimetal tube functions may be gathered from Figs. 1 and 2. The carbon arc is depicted akin to the sun shining through the window and falling upon the right-hand portion of the teeter-totter arrangement. This portion becomes warm, as evidenced by the "thermometer". The control element, as shown by the figure of a man resembling a bimetallic tube, immediately moves to the shaded portion of the sawhorse, causing it to engage the negative carbon drive motor and slow it down. At the same time the positive carbon motor is released so that it will speed up.

This coordinated action has its effect upon the feed of the carbons. The positive carbon is fed slightly faster than it is burning, while the negative carbon is slowed down so that it recedes slightly, thereby shifting the position of the light source as depicted in the right-hand area of the cartoon. This causes the bimetal tube "man" to again feel uncomfortable and to run to the other side of the see-saw. Thereby the positive carbon drive is slowed down and the negative carbon drive released (Fig. 2).

This action of running back and forth analogizes the operation of the tube in the lamphouse which is never in an inoperative position. It is constantly "sensing" slight variations in the position of the positive carbon and shifting the arc ever so slightly one way or the other so that it remains in exact focal relationship with the reflector. This slight shifting is so minute and so continuous that it cannot be detected either by the projectionist in watching the lamphouse closely or by those watching the screen. In fact, the total movement of the positive carbon from the exact focal point of the reflector usually does not vary more than plus-or-minus 6 to 8 thousandths of an inch.

Figure 3 shows the wiring diagram, giving the arrangement of the bimetallic tube as actually incorporated in the control system of the lamphouse. As will be noted, the control relay is so arranged that it will shunt out either one of the two resistors that are in series with the fields of the feed motors. Thereby the negative is slowed down and the positive speeded up, or *vice versa*, in the same manner that the bimetal tube in our cartoon controls the motors in response to the position of the source of energy.

Value Easily Proven

The stability of the Strong control system is easily demonstrated. The arc can be struck, the position of the positive crater deliberately thrown off its intended position to such an extent that there will be no light on the screen, the negative carbon positioned so that there is either an extremely short or long carbon arc-gap length; and without further attention both carbons in several minutes will *automatically* return to the correct arc-gap length, with the relation of the positive carbon to the optical system being returned to its optimum position. The light on the screen will be at maximum and uniform brilliancy.

It should be remembered that the length of the arc-gap or distance

FIGURE 1

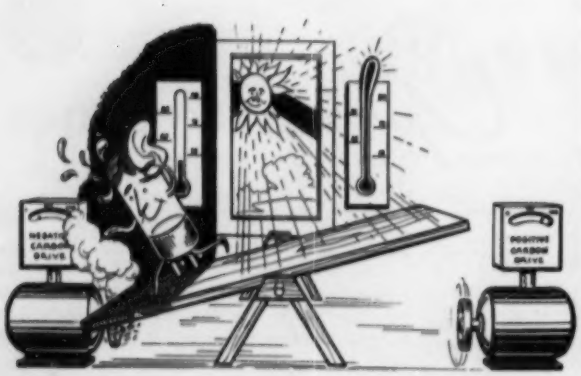
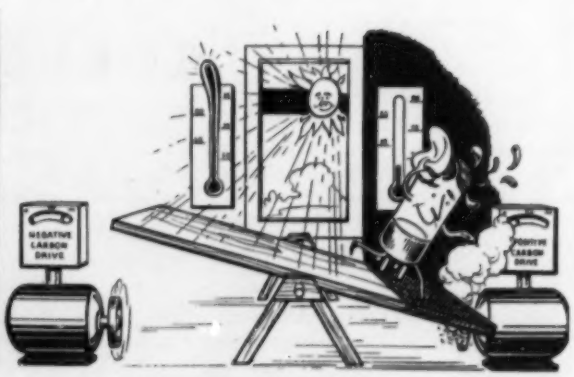


FIGURE 2



between electrodes is governed primarily by arc voltage or the electrical "pressure" between the carbons, which is a resultant of the power that is fed to the arc, consequently the distance between the carbons should be properly regulated by the output of the generator or rectifier. In the case of the rectifier the output is simply regulated by changing taps; in the case of the generator the power output

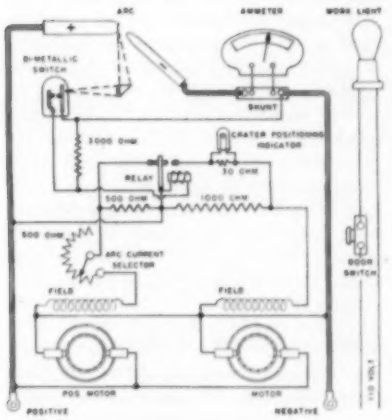


FIGURE 3

is regulated by changing the ballast resistance in the arc power supply circuits between the generator and the lamp.

As the power to the arc is increased, nothing else having been disturbed, the length of the arc-gap will gradually increase. If the power to the arc be decreased, the length of the arc-gap will gradually decrease. Such a change of input power will not cause a change of arc amperage beyond the initial surge at the instant of change. If the lamp be allowed to burn at either increased or decreased power until stability is reached, nothing else having been disturbed, the arc amperage or current will finally settle to the same value as before the change of input power to the lamp was made.

Amperage-Feed Relationship

The amperage at which the lamp will operate and the rate at which the carbons are being fed are two factors which are closely related. The higher the rate of feed that is selected, the higher the arc current will be. The setting of the feed control of this automatic lamp will simply result in a feeding of the carbons *at a certain average rate.*

This rate of dual feeding of the carbons causes the arc current to be

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established at a value so as to effect a *balance* between the rate at which the carbons are being *fed* and the rate at which the carbons are being *burned*. If the rate of feed is speeded up, the carbons will consequently have to be burned off at a faster rate. So in the adjustment of this or any type lamp it should be remembered that the motor or carbon feed rate controls are adjusted simply to attain the desired burning rate or arc amperage, and the power supply is adjusted only to obtain the desired arc-gap length. If the arc-gap be too long, decrease the power supply by lowering the rectifier output.

If a generator or commercial D. C. be in use, *increase* the line ballast by pulling out the switches or disconnecting links so as to increase the voltage-drop across the ballast. If the arc-gap be too short, increase the power supply by raising the rectifier output. If generator or commercial D. C. be in use, *decrease* the line ballast by throwing in additional switches or connecting additional links so as to decrease the voltage-drop across the ballast.

After the correct arc setting is thus obtained as determined by the arc-gap length, no further adjustment of the power supply to this automatic lamp will be necessary—unless as is indicated here:

Possible Adjustment Suggestions

When the crater-positioning indicator light (located on the control panel just above and to the right of the positive manual carbon-feed crank) is "on" it indicates that the positive carbon is being fed at a faster rate than was selected. When this light flashes "off" it indicates that the positive carbon is being fed at a slower rate than was selected.

If the crater-positioning indicator light remains "off" for long periods, or if the arc-gap becomes too short, or the carbons "overfeed," the power to the arc is too low for the burning rate selected and the power supply must be increased.

Conversely, if the crater-positioning indicator light remains "on" for long periods of time or if the arc-gap becomes too long, or if the carbons "underfeed," the power supply to the arc is too high for the burning rate selected and the power must be decreased.

Small, Mobile Tv Unit Gives 9 x 12 Picture

EXHIBITS OF closed-circuit Tv apparatus for both theatre and individual use featured the annual show of the Institute of Radio Engineers, recently concluded in New York City. Most complete of the exhibits was General Precision Labs' portable Tv projection unit for use in hotels, meeting halls, and also in small theatres. These new units provide a picture up to 9 by 12 feet, accommodating audiences of about 300 people.

A somewhat similar Tv projector is that of the Fleetwood Corp., Toledo, Ohio. This unit, priced at $2,450, is expected to appeal to small theatres which cannot afford the much higher price of more powerful theatre Tv equipment. Both the GPL and Fleetwood projectors operate from a 40-kilovolt power tube linked to a Schmidt optical system. Each unit is simple to operate and is set on wheels so that it can be moved easily from one location to another.

Optical Systems Differ

A difference between the two units is in the design and location of the optical systems. GPL locates the projection tube and reflector in a maneuverable projection barrel at the top of the cabinet; the Fleetwood projection tube beam is directed downward into a 14-inch concave circular mirror of Schmidt system. This beam is deflected to the screen by another mirror set at a 45-degree angle at the top of the set. Positioning of the picture on the screen is accomplished by means of knobs located on a control panel in the rear.

The Fleetwood projector contains a built-in speaker for use with small groups and plug-in facilities for driving fixed speakers in larger auditoriums. An audio amplifier and a speaker system is listed as optional equipment for the GPL projector.

Hotels Seen Large Purchasers

Some time ago, Theatre Network Television, which produces closed-circuit Tv shows for both entertainment and industrial purposes, purchased a large number of these GPL projectors for use in hotels. The first multiple-purchase of the Fleetwood equipment was by the Sheraton Hotel chain which ordered 11 for closed-circuit conference hook-ups and other applications.

In addition to its Tv projector, GPL also has available small but versatile Tv cameras adapted to a number of industrial and other closed-circuit uses in combination with its Tv projector.

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THE DEVELOPMENT OF THE MOTION PICTURE PROJECTOR

(Continued from page 15)

use and, later, through the Patents Co., participated in royalties collected for their use.

Judge Dickinson said: "Every theatre was required to pay royalties for the use of projection machines, even where the machine had been *owned* before the combination was formed." He overlooked, or ignored, the fact that the machines had been sold *without license or other authority from the owners of the patents!*

Defends the Patents Co.

I maintain that the Patents Co., instead of being an organization in *restraint* of trade (which the Sherman Law was designed to prohibit)was in effect an organization to *facilitate* trade, for the reason that prior to the date of the Patent Co.'s acquiring the right to grant licenses, under all the controlling patents, no producer or exhibitor could do a legitimate business (that is, a business that did not infringe one or more patents); and the fear of running counter to the patent laws certainly has a deterrent effect upon everybody except those piratically inclined.

Many erroneous statements have been made and published as to when and by whom the first motion picture projection machine was made. I have been asked many times to list those basic inventions upon which, in my opinion, the motion picture industry was established —as shown by U. S. Patent Office records. Subsequent to this early experience I was called upon to testify, as an "expert," in litigation under my patents, and later under the Edison and other patents owned by the Patents Co.

Basic Inventions Listed

There have been a great variety of motion picture projectors, produced under different names, that vary as to their mechanical details but embody all the inventions that may be called basic —basic in the sense that they are necessary for successful projection and have been used since the beginning or near the beginning and are still being used. The following is my list of the eight most important inventions in the motion picture art:

(1) The Edison camera: (Patent No. 589,168, dated Aug. 1897; filed Aug. 24, 1891). This was the first camera employing a perforated film which was given an intermittent motion so that a given number of perforations and a given number of pictures would be intermittently moved, rather than *given length of film*. The result was a film having equally-spaced, juxtaposed pictures throughout its length. The first practicable motion picture camera produced.

(2) Edison motion picture film: (Patent reissue No. 12,038, Sept. 30, 1902; filed Aug. 24, 1891). The first perforated motion picture film having equally-spaced, juxtaposed pictures, necessary for acceptable projection and an essential part of every motion picture projector in use the world

(Continued on next page)

Theatre Seating Capacity Now Greater than 1948

Although there has been a decrease in the *number* of operating theatres during the past six years, overall seating capacity of all theatres has actually increased as a result of drive-in construction.

Between March, 1948, and March, 1954, there were 6,280 theatre closings, according to a survey made for the Council of Motion Picture Organizations. However, with the addition of 807 new indoor theatres and 3918 drive-ins during the same period, plus a number of reopenings, the total number of theatres in operation as of last March was 18,351, a net loss of only 56 theatres during the six-year period.

In addition, the number of "seats," including drive-in theatre capacity, has actually increased during the six-year period. A 600-car drive-in, for instance, is considered to have 2,400 seats—four per car. The average per-car seat occupancy of drive-ins is less than this, about 2½, but it must also be considered that the average occupancy of indoor theatre seats over a weekly period is usually less than 50%, if big-city first-run houses are excluded from the count.

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over today. This Edison film, first made some time prior to 1891, was 1⅝-inch wide over all, had four perforations to each picture, being 1 inch wide by ¾ inch high.

(3) The Edison peep-hole Kinetoscope: (Patent No. 493,426, dated March 14, 1893; filed Aug. 1891). This was the first motion picture exhibiting machine employing a perforated film with equally-spaced, juxtaposed pictures. The first practicable motion picture exhibiting machine of *any* kind, *but incapable of projecting pictures successfully* because it gave the film a *continuous* instead of an *intermittent* motion.

(4) The Jenkins and Armat *intermittent* projector: (Patent No. 586,953, dated July 20, 1897; filed Aug. 28, 1895). The first motion picture projector giving the pictures an intermittent motion with *a long period of rest and exposure.* A mechanical failure, it nevertheless demonstrated the necessity and value of long exposure, essential to successful projection.

(5) The Vitascope invented and patented by Thomas Armat: (Patent No. 673,992, dated May 14, 1901; filed February 19, 1896). The first projector machine employing a loop-forming means and embodying a *practicable* intermittent movement giving the pictures the required long period of rest and exposure. A loop-forming means is essential in projection machines employing a long length of film.

(6) The star-wheel intermittent movement invented and patented by Thomas Armat: (Patent No. 578,185, dated March 2, 1897; filed September 25, 1896). By means of this intermittent movement a small sprocket carrying the film could be given a *gradually accelerated* intermittent movement without film wear and tear and without jar to the mechanism. This movement superseded all others by 1897.

(7) The Albert E. Smith framing device: (Patent No. 673,329, dated April 30, 1901; filed March 15, 1900). This device frames the pictures while the machine is running, and is a practically essential device.

(8) The John A. Pross shutter: (Patent No. 722,382, dated March 10, 1903; filed January 19, 1903). An important improvement for reducing scintillation (flicker). Not as essential in 1895-96 when only Edison films were obtainable, since these films were taken at approximately 40 per second, but quite essential wih pictures taken at the later commercial lower rates.

The foregoing is a complete list of the pioneer inventions covering the essentials of the motion picture camera, the film, and the projector—all in universal use today in the most modern equipment. The addition of color and sound accompaniment belong to a later period.

Camera, Projector Differences

For the possible benefit of modern workers in the art, I pointed out some of the differences between a motion picture camera and a projector, from the patent and invention standpoint. These differences were emphasized by me in the U. S. Patent Office interference in which my Vistascope patent, No. 5 on the list, was involved.

I am not an attorney, but my familiarity with the art and its requirements enabled me to conduct this case successfully "on my own" preparing the brief and arguing the case personally before the several tribunals of the Patent Office and the Court of Appeals of the District of Columbia, all of which tribunals accepted my views and decided in my favor.

In taking a picture of an object in motion it is essential to make the exposure of the image on the film as short as possible, consistent with the sensitiveness of the film, because if this be not done, there will be time for the image of the moving object to be displaced on the sensitive film, causing a blurred or indistinct picture.

In the projection process the reverse is true: here a picture is fixed beyond the possibility of any such image movement's causing blur, and the longer the picture is exposed to the eye the better the results.

The Problem of Flicker

With a camera we are dealing with a *moving* object and a sensitive film. With a projector we are dealing with a *fixed* picture and the human eye. No question of flicker enters into the problem of *taking* pictures; but it does enter very extensively into the problem of *exhibiting* pictures.

In a camera, the sensitive film does not cooperate with the mechanism to produce a complete or final result. The film has to be taken out, developed and printed before the operation is complete. The film is run through the camera *but once.* The Patent Office and the law courts held that the film is no more a part of the camera than the paper is of a printing press!

In an exhibition machine the film with pictures on it is an *essen ial* part of

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the apparatus: it is a part of the mechanism which *cooperates* with the other parts to produce the *final results*. In exhibition the film is used over and over again in the projector and has to be so used whenever the film is exhibited. In passing upon this question the U. S. Patent Office had this to say:

"If Latham with his Exhibit Machine No. 12, and Casler with his Exhibit No. 1 Machine, both of which were *taking* cameras could *without invention* have produced a machine of the construction called for by the issue, it is remarkable that they did not do so at any proven date before the filing of their application.

"The evidence shows that neither Latham nor Casler was an ordinary mechanic but that they were inventors of considerable capacity; yet neither produced a machine having the new and beneficial results which are claimed for the machine described in Armat's application . . .

Intermittent Movement a 'Must'

"In our opinion, proof of the existence of a camera for *taking* pictures of an object in motion, said camera having, in combination with a sensitive film, a mechanism for giving the film an *intermittent* motion in which the periods of pause exceed the period of motion; said mechanism comprising, in addition, the other elements called for by this issue and a shutter, is not a *reduction to practice* unless there is proof to show that when this camera was used for projecting, the shutter was either omitted altogether or was so adjusted as to provide for such relative periods of pause and illumination and periods of motion as are called for by this issue."

[THE END]

WIDER DRIVE-IN SCREENS

(Continued from page 14)

with a tilted, heat-reflecting, dichroic reflector. This reflector removes about 40% of the heat from the light beam, while it cuts down visible rays by only 6 to 8%. From a practical viewpoint, this slight decrease in light is of minor consequence.

A group of about half a dozen experienced engineers was gathered in one of our experimental projection rooms, and after dropping the heat reflector into the light beam, and then removing it several times, they all agreed that they could not tell, with any accuracy, whether the heat reflector was in or out of the light beam. This dishroic reflector is kept cool by a constant flow of air from a small blower.

Multiple-Channel Sound

The past season has marked the introduction of multiple-channel sound in the drive-in theatre. Fig. 3 shows a typical speaker post in the Belmont Auto Drive-In. Two junction boxes and four drive-in theatre speakers are

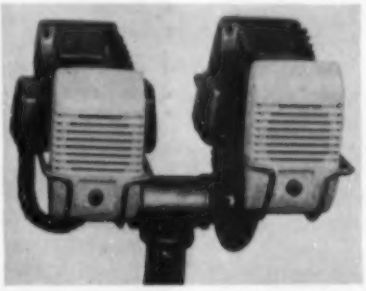

FIG. 3. Two separate speaker installation at the Belmont Drive-In, near Dayton, Ohio.

mounted on each post so that each car is equipped with both a right-hand and a left-hand speaker.

Four-track magnetic recordings of a conventional CinemaScope print are resolved into two-channel sound in the following manner: sound for the left side of the screen is impressed on the left-hand speaker, while that for the right side goes to the right-hand speaker.

Sound for the center of the screen is divided equally and impressed simultaneously on both the right- and left-hand speakers, so that the ear interprets the volume level to be the same as that for the sound already coming from each side of the screen. The sound effects track is divided in a similar manner.

(More on this, next page)

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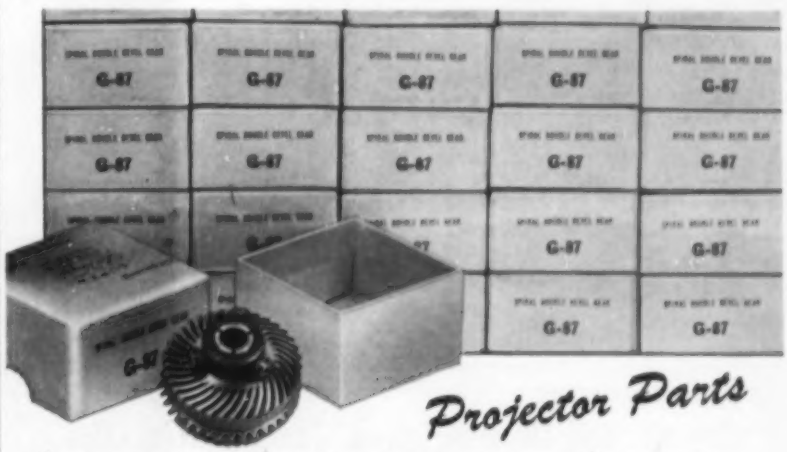

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A few years ago many of us felt that it might be impractical to attempt to introduce stereophonic sound in drive-in theatres. Because of this, we were extremely careful in our preliminary tests to be sure that the directional effect of this two-channel stereophonic sound was really effective.

Since both of the speakers in the car subtend a very much larger angle at the viewer's ears than is the case in a conventional indoor theatre, the directional effect is materially enhanced. One of our main concerns was that this enhancement might result in a lack of naturalness. Actual operating tests, however, have convinced us that the effect on the average patron is highly satisfactory.

The second important advantage of two speakers in one car is that obtained by the spatial effect of multiple-sound sources. This improvement has been so great that at the Belmont Auto Drive-In both speakers run continuously even on single-channel sound transmission from a conventional single-track print.

Two- vs Three-Speaker Units

Comparative tests of both two-speaker and three-speaker single units were carried on, and it was our conclusion that the two-speaker unit in a single housing was, in general, about as satisfactory as the three-speaker unit. Since the three-speaker unit is generally driven by three separate channels, this means that three complete separate channels of sound amplification and sound distribution must be employed.

Because of the elimination of a complete channel of amplification and distribution, either the double-speaker unit or the two separate speakers may be a more practical method of operation than the three-channel, three-speaker setup.

The double-speaker single unit is admittedly less cumbersome to handle, but it does not have as marked a directional effect on stereophonic sound as do the two separate speakers.

PROJECTION LIGHT SOURCES

(Continued from page 12)

dioxide gas which passes off; but the metallic oxides are solids which cannot burn.

The rare-earth oxides are especially troublesome because they are "basic anhydrides" which react chemically with the "acid anhydride" of heated glass (silicon-dioxide) to form small amounts of rare-earth silicates. This chemical reaction "frosts," or etches, the surfaces of the glass near the top of the mirror where the arc dust normally settles.

Etching may be greatly delayed by wiping the dust from the mirror after every show with a clean, dry cloth. If the dust be left on the mirror day after day, no amount of scrubbing will remove it.

Cerium Carbide the Culprit

Pitting of H-I arclamp reflectors by copper splashings and by liquid cerium carbide ejected forcibly from the positive crater when the arc is struck presents a difficult problem. The inside dowser goes far to prevent mirror pitting, but it cannot wholly prevent it because an accidentally shortened arc-gap causes cerium carbide to be formed while the dowser is open.

Cerium carbide is a nuisance to

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the projectionist in two ways. As far as mirror pitting is concerned, this curious chemical compound eats holes in glass even more rapidly than does molten copper. First, the carbide is usually hot enough to melt the glass when splashed upon the surface of the mirror. Second, it exchanges its carbon atoms for the silicon atoms of the glass. Cerium silicide is produced by this reaction; and of the carbon atoms liberated, half remain admixed with cerium silicide as free carbon, and the other half take oxygen atoms from the glass and turn into molecules of carbon dioxide gas.

This complex and vigorous reaction leaves the pit marks filled with a black mixture of cerium silicide and carbon. The most energetic scrubbing and scraping fails to remove it, whereas copper droplets embedded in the glass come off quite easily.

It happens that the arc-burning conditions which favor the production of cerium carbide also cause jets of superheated carbon vapor to be shot out from the positive carbon. Now, the moment that the carbon vapor hits the surface of the mirror, it condenses to black soot, the purest form of carbon known. Even though soot does not react chemically with the glass, its blackness makes it an almost perfect absorber of arc radiation which it turns to heat. The temperature of the soot spots is sufficiently high to crack any but the strongest mirrors.

Regular Cleaning Essential

Moderate pitting fortunately does not appreciably impair the optical efficiency of a mirror. A film of arc dust has a much worse effect, yellowing the light as well as dimming it. Screen illumination may therefore be maintained at or near maximum levels by the simple expedient of washing arclamp reflectors at least once a week with strong soap and water. If badly pitted and etched, Bon Ami should be used in place of ordinary soap. The writer uses the cake form of Bon Ami because it is convenient to apply the Bon Ami to the glass surface with a wet cloth which is first rubbed on the cake.

At all events, the silver-protecting backing on the mirror should be kept dry, and any film of soap on the front of the mirror removed by rinsing with pure water and wiping with a *clean* cloth.

Now let's consider the second way in which cerium carbide hampers the projectionist. It pits mirrors, we know; and it also does something else. As stated previously, cerium carbide is formed in the white-hot positive crater when arc voltage (sometimes called "arc voltage-drop") is too high for the length of arc-gap employed. Stated in different terms, cerium carbide is formed whenever the arc-gap is too short.

The temperature of the positive crater is so high, however, that the carbide boils and gradually evaporates even when it is not splattered upon the mirror. The vapor readily condenses upon any nearby object which is cool enough. The tip of the negative carbon, which is cooler than the positive crater even though glowing, is such an object. Cerium carbide vapor is carried across the hot arc-stream to the tip of the negative where it condenses as a red deposit.

Deposit on Carbon Tip

This red carbide deposit causes trouble for the projectionist because it is a non-conductor of electricity. If very much of the negative tip is

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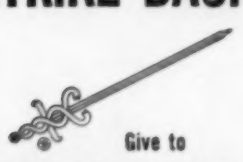

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covered by cerium carbide, arc voltage will drop and the light begin to flicker. The feed motor will then respond by shortening the gap, further aggravating the condition and possibly causing the negative to shade the positive crater from the mirror.

It is advisable, however, not to readjust the motor rheostat to decrease feeding speed, but rather to let the motor follow its natural inclinations. The carbide tip may be removed from the negative carbon when the end of the reel is reached.

Cerium carbide, although a stable compound, is gradually decomposed by the ever-present moisture in the air to form acetylene gas and cerous hydroxide. This hydroxide is itself oxidized by the air to a brown powder, cerium oxyhydroxide, which creates no operating difficulties.

The fact that cerium carbide takes a little time to disintegrate is of the utmost importance to projectionists. If the lamp is shut down for five minutes or less, the carbide may not have had time to decompose completely before an attempt is made to relight the arc. In such a case the insulating properties of the carbide may block the flow of current. The projectionist may suspect a bad connection in the lamp or ballast rheostat, and lose valuable show time in tracking down a defect which does not exist.

If the voltmeter reveals that the generator or rectifier is operative (showing that no fuses are blown), the projectionist should inspect the tip of the negative carbon before doing anything else when a H-I arc fails to light. The presence of cerium carbide is revealed by its red color; and the troublesome compound may be removed by filing it off or destroyed by moistening the tip of the negative carbon. Avoid a shock and an overturned projector by turning off the lamp-table switch before touching the carbons.

L-I arcs are free from mirror-pitting and carbide difficulties for the obvious reason that the arc-stabilizing cores of the L-I carbons contain no cerium or other rare-earth compounds. The potassium compounds in the cores of L-I positives produce a relatively light ash.

Lamp Circuits Not Complex

Arclamp circuits are electrically simple, consisting of direct connection of the carbons to the two output terminals of the apparatus which supplies the D.C. When the source has constant-volt characteristics, as is the case with generators for "parallel operation" (both arcs powered by a single generator), a ballast rheostat must be connected in series with each arc to counteract the tendency of the carbon arc to lose all its resistance to the flow of current.

No ballast is necessary, however, when the source has the falling-volt characteristics possessed by rectifiers and f-v generators, devices which can power only one arc.

The size of the wires and lead-in cables of an arclamp circuit is determined by the number of amperes flowing through the arc. Needless to say, the conductors should be several sizes larger than is actually needed, a precaution which eliminates the necessity of a complete rewiring job if the lamp equipment is ever increased in power.

This is a matter which should be given serious thought when the generator is located in the cellar or at some other point far away from the projection room. Line voltage-drop is not harmful in itself (it can be regarded as part of the ballast voltage-drop, and the ballast rheostats readjusted accordingly); but wires so small that the current heats them are dangerous and not permitted by building inspectors, insurance companies, or fire officials.

Care of Contact Surfaces

The connecting lugs and table switches, relays, *etc.*, require little more than infrequent, but periodic, examination of all contacting surfaces and the removal of corrosion and "burns" with the finest emery cloth. All such surfaces should be *polished*, not *roughened*, for roughening increases surface area and speeds corrosion. Connections should be tight enough to prevent the generation of heat by current flowing through them.

The condition of the silver or bronze carbon-contacting surfaces of the carbon-holders is also important. These should never be filed unless absolutely necessary. Quite aside from roughening them, use of the file runs the risk of destroying their flatness. They should be carefully polished by means of the very finest emery cloth wrapped around a suitable tool, but no more often than absolutely necessary.

Rotating-positive, H-I feeding heads require special attention. A wire brush serves to remove foreign particles, and fine emery cloth wrapped around a carbon may be used for polishing the actual contact surfaces. Badly burned and mechanically worn heads should be replaced.

[THE END]

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